FINAL
THIRD FIVE-YEAR REVIEW REPORT FOR
OPERABLE UNITS 2 AND 4 SCHOFIELD ARMY BARRACKS, SITES 12 AND 19
OAHU, HAWAII

2007 THROUGH 2011

31 AUG 2012

U.S. Army Environmental Command
2450 Connell Rd., Bldg 2264
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Directorate of Public Works
United States Army Garrison, Hawaii
948 Santos Dumont Avenue
Building 105, Wheeler Army Airfield
Schofield Barracks, Hawaii 96857-5013

Contract No.: W91ZLK-05-D-0009
Delivery Order 0004

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Contract No.: W91ZLK-05-D-0009
Delivery Order 0004
Subcontract No.: AMEC.Subk.5404.004

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10 SEP 2012
Date

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ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
AMEC	AMEC Environment & Infrastructure, Inc.
ARARs	Applicable or Relevant and Appropriate Requirements
Army	U.S. Department of the Army
ASTS	Air Stripper Treatment System
bgs	Below ground surface
CCl_4	Carbon tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CRM	Cement Rubble Masonry
CWA	Clean Water Act
DLNR	Department of Land and Natural Resources
DPW	U.S. Army Garrison, Hawaii Directorate of Public Works
ECC	Environmental Chemical Corporation
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FFA	Federal Facility Agreement
HAR	Hawaii Administrative Rules
Harding ESE	Harding ESE, Inc. (now AMEC)
HC	Hawaii Code
HDOH	Hawaii Department of Health

HLA	Harding Lawson Associates (now AMEC)
HRS	Hawaii Revised Statutes
IRP	Installation Restoration Program
LEL	Lower Explosive Limit
MACTEC	MACTEC Engineering and Consulting, Inc. (now AMEC)
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
mm	Millimeter
MSWLF	Municipal Solid Waste Landfill
Navy	U.S. Department of the Navy
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operations and Maintenance
OE	Ordnance explosives
OU	Operable Unit
PA	Preliminary Assessment
PCE	Tetrachloroethene
ppb	Parts per billion
RAO	Remedial Action Objective
RI	Remedial Investigation
ROD	Record of Decision
Schofield Barracks	Schofield Army Barracks, Island of Oahu, Hawaii
SDWA	Safe Drinking Water Act
SI	Site Investigation

SIC	Sandwich Isles Communications
TBC	To Be Considered
TAMC	Tripler Army Medical Center
TCE	Trichloroethene
USAEC	United States Army Environmental Command
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency (now USAEC)
USC	United States Code
VOC	Volatile Organic Compound
WTP	Water treatment plant

EXECUTIVE SUMMARY

This report documents the third five-year review conducted for Schofield Army Barracks, Oahu, Hawaii, (Schofield Barracks) and evaluates the protectiveness of the implemented remedies for Operable Unit (OU) 2 (Groundwater) and OU 4 (Former Landfill) at Schofield Barracks. This five-year review covers the period from 1 January 2007 to 31 March 2012. OU 1 and OU 3 achieved no further action during the OU 1 and OU 3 Remedial Investigations (RIs) and thus do not require five-year reviews.

The purpose of the five-year review is to determine if the remedy remains protective of human health and the environment and whether the remedy is performing as designed. U. S. EPA guidance proposes three key questions to be addressed in the five-year review to achieve this purpose. They are as follows:

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, cleanup levels, and Redial Action Objectives (RAOs) used at the time of the selection still valid?
- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?"

The OU 2 ROD (HLA, 1996d) documents the selected remedy, summarizes the rationale for remedy selection, identifies ARARs, and documents other aspects of the decision. The OU 2 remedy primarily consists of the following components:

- Wellhead treatment of extracted groundwater for domestic and municipal use that exceeds the Maximum Contaminant Levels (MCLs) for trichloroethene (TCE) and carbon tetrachloride (CCl_4) at the Schofield Barracks Supply Wells and Kunia Village- Wells 3-2803-05 and 3-2803-07.

- Wellhead treatment has begun at a new air stripper treatment system that was installed at Waipio Acres at well 3-2801-03 since the second five-year review. This well and treatment system were installed by Sandwich Isles Communications.

- Long-term groundwater monitoring to identify increasing concentrations of TCE and CCl_4 (contaminants) in groundwater to allow the Army plan and allocate resources for and institute wellhead treatment of domestic use groundwater before contaminant concentrations reach the MCLs.

- Conducting five-year reviews.

The treatment portion of the remedy was implemented at Schofield Barracks and Kunia Village before the Record of Decision (ROD) was approved in September 1996 (i.e., in 1986), and an interim long-term monitoring program was initiated in June 1996. The long-term monitoring program for OU 2 was implemented in April 1997 and continues to the present (2012). Operation and maintenance (O&M) costs for wellhead treatment at the Kunia Village wells are reimbursed by the Army.

The OU 4 ROD (HLA 1996c) presented a response action for OU 4, summarizes the rationale for remedy selection, identifies ARARs, and documents other aspects of the decision. The OU 4 remedy consists of the following components:

- Regrading and repairs to the existing landfill cover system
- Maintenance of the existing landfill cover and venting system
- Restricting access to the former landfill
- Long-term groundwater and landfill gas monitoring
- Conducting five-year reviews

Implementation of the selected remedy for OU 4 occurred in several construction phases. The trigger for the first five-year review was the start of OU 4 remedy construction on 10 March 1997. OU 4 achieved construction completion when the final inspection was performed on 21 July 1998. Landscaping activities were completed on 7 August 1998. O&M activities have been conducted since the completion of the remedy, and include general inspections, general maintenance, groundwater and landfill gas monitoring, record keeping, and reporting. The triggering action for this third five-year review was the approval of the second five-year review report on 30 September 2007. This third review is to be completed and approved by 30 September 2012.

Conclusions and recommendations related to this third five-year review are included in the Five-Year Review Summary Form, which is included in this executive summary. This second five-year review identified that the remedies are in accordance with the requirements of the OU 2 ROD and the OU 4 ROD. The remedies are functioning as designed and continue to be protective of human health and the environment as demonstrated by quarterly groundwater and landfill gas monitoring results and quarterly inspection of the former landfill. Results from the monitoring well network show that the plumes are not migrating downgradient. The quarterly landfill gas monitoring program was recommended to be discontinued in the Second Five-Year Review and was discontinued in late 2007, as methane concentrations in the gas monitoring probes in the previous ten years had been far less than the 5 percent limit defined by the State.

The Army will continue to maintain and operate the groundwater treatment systems and the monitoring well network until TCE and CCl_4 MCLs are achieved in groundwater, and the Army will respond to any unforeseen increases in TCE levels downgradient of Schofield Barracks. The Army will also continue maintenance of the landfill cover system and institutional controls to prevent the contact of contents with human receptors or the environment. Therefore, the remedies continue to be effective and protective. The next five-year site review is scheduled to begin by March 2017, and be completed and approved by 24 September 2017.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Schofield Army Barracks, Oahu, Hawaii		
EPA ID: HI7210090026		
Region: 9	**State:** HI	**City/County:** Wahiawa/Honolulu County
SITE STATUS		
NPL Status: Deleted		
Multiple OUs? OUs 2 and 4 Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** U.S. Army		
Author name (Federal or State Project Manager): ECC; AMEC Environmental & Infrastructure		
Author affiliation: Consultant		
Review period: 1 March 2012 – 24 September 2012		
Date of site inspection: 23 and 29 March 2012		
Type of review: Statutory		
Review number: 3		
Triggering action date: 30 September 2007		
Due date *(five years after triggering action date)*: 30 September 2012		

Five-Year Review Summary Form (continued)

The table below is for the purpose of the summary form and associated data entry and does not replace the two tables required in Section VIII and IX by the FYR guidance. Instead, data entry in this section should match information in Section VII and IX of the FYR report.

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU 4

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU 2	**Issue Category: Monitoring**			
	Issue: One new irrigation well has been placed inside the plume boundary and three wells have been placed outside the plume boundary but within the extended monitoring well boundary.			
	Recommendation: Evaluate the wells for inclusion in the monitoring well network and improve the implementation of the ICs with better coordination with the State of Hawaii water well permitting program.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA/State	31 December 2012

To add additional issues/recommendations here, copy and paste the above table as many times as necessary to document all issues/recommendations identified in the FYR report.

Protectiveness Statement(s)

Include each individual OU protectiveness determination and statement. If you need to add more protectiveness determinations and statements for additional OUs, copy and paste the table below as many times as necessary to complete for each OU evaluated in the FYR report.

Operable Unit: OU 2	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy at OU 2 is expected to be protective of human health and the environment and in the interim, exposure pathways that could result in unacceptable risks are being controlled.		

Operable Unit: OU 4	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy at OU 4 is expected to be protective of human health and the environment and in		

the interim, exposure pathways that could result in unacceptable risks are being controlled.

Sitewide Protectiveness Statement (if applicable)	
For sites that have achieved construction completion, enter a sitewide protectiveness determination and statement.	
Protectiveness Determination: Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: Because the remedial actions at OUs 2 and 4 are protective, the site is protective of Human Health and the environment.	

1.0 INTRODUCTION

This five-year review of Schofield Barracks, Operable Unit (OU) 2 and OU 4 was conducted by AMEC Environment & Infrastructure, Inc. (AMEC) for the U.S. Army Garrison Hawaii (Army), under subcontract agreement AMEC.Subk.5404.004 to ECC, the Prime Contractor for this project. This five-year review report was prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), the National Contingency Plan (NCP), and the Comprehensive Five-Year Review Guidance Document (United States Environmental Protection Agency [EPA], 2001).

This third five-year review is prepared for Schofield Barracks OU 2 and OU 4, and covers the period from 1 January 2007 to 31 March 2012, pursuant to the OU 4 Record of Decision (ROD) (Harding Lawson Associates [HLA], 1996c) and the OU 2 ROD (HLA, 1996d). The first five-year review report covered the period from March 1997 to September 2001 and was completed by Harding ESE (2002). It was approved by the Army in September 2002. The second five-year review report covered the period from 1 November 2001 to 31 December 2006 and was completed by ECC and MACTEC (2007a). It was approved by the Army in September 2007.

The following subsections present the purpose, authority, organizations and agencies involved in this review, a description and status of the OUs, and report organization.

1.1 Purpose

The purposes of this five-year review for Schofield Barracks OU 2 and OU 4 are to:

- Evaluate whether the implemented remedies described in the OU 2 ROD (HLA, 1996d) and the OU 4 ROD (HLA, 1996c) are protective of human health and the environment as intended. Evaluation of the continued protectiveness of the remedies is supported by field observations, data gathered during the five-year review process and interpretations of the data and observations.

- Identify deficiencies or issues, if any, found during the review.
- Recommend corrective action to address the deficiencies or issues.

1.2 Authority

The Army must implement five-year reviews in accordance with CERCLA and the NCP. CERCLA §121, as amended, states, "If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less than each five years after the initiation of such remedial action…" This requirement is further supported by NCP; 40 Code of Federal Regulations (CFR) 300.430(f)(4)(ii), which states, "If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

1.3 Organizations and Agencies Involved

The Army is the lead agency under CERCLA and is conducting the five-year review. EPA and the Hawaii Department of Health (HDOH) are the regulatory agencies responsible for reviewing the five-year review report. ECC is the primary contractor and AMEC is their subcontractor. ECC conducted groundwater monitoring for OUs 2 and 4 from February 2007 to the present. Groundwater monitoring was conducted in accordance with the Final Operation and Maintenance, and Long-Term Groundwater Monitoring Plan for OU 2 (HLA, 1996e).

Quarterly landfill inspections are performed in compliance with the Final Operation and Maintenance and Long-Term Monitoring Plan for Operable Unit 4 (OU 4 O&M Plan) (HLA, 1996f). ECC/AMEC conducted these landfill inspections from 1 March 2007 through the present. Quarterly landfill gas monitoring was also conducted for OU 4 for three quarters in 2007 before being eliminated in the Final Second Five-Year Review (ECC & MACTEC, 2007).

1.4 Overview of Schofield Barracks

Four OUs were established to address the potential areas of contamination at Schofield Barracks:

- OU 1 – Possible TCE Sources
- OU 2 – Groundwater Contamination
- OU 3 – Remaining Onpost Sites Suspected to Contain Contamination Sources
- OU 4 – Former Schofield Barracks Landfill

OU 2 and OU 4 proceeded through the CERCLA process and are included in this five-year review. OU 1 and OU 3 achieved no further action following the RIs because no onpost sources of TCE contamination were found (HLA, 1995b; Uribe & Associates, 1996). Therefore, they are not included as part of this five-year review. The following subsections provide descriptions of OUs 2 and 4.

1.4.1 Operable Unit 2

OU 2 consists of the groundwater beneath Schofield Barracks, which is contaminated primarily with trichloroethene (TCE) and carbon tetrachloride (CCl_4). The groundwater is 550 to 650 feet below ground surface (bgs) and is part of the groundwater body known as the Schofield High-level Water Body. It is called a "high-level" water body because the groundwater levels beneath Schofield Barracks are much higher than groundwater levels in the nearby coastal areas because of underground geologic structures that act as dams to groundwater flow. Most of the groundwater beneath Schofield Barracks originates as rainfall in the Koolau and Waianae mountain ranges to the east and west. This rainfall seeps into the ground in the mountain areas and moves through the subsurface eventually reaching Schofield Barracks. A small amount of water also seeps into the ground in the Schofield Barracks area and reaches the underlying groundwater. The groundwater beneath Schofield Barracks eventually flows over the northern and southern groundwater dams into the coastal water bodies to the north and south.

Groundwater data collected during the OU 2 Remedial Investigation (RI) suggested that at least two separate TCE and CCl_4 sources exist. It is likely that the TCE migrated from these ground surface locations through the soil and bedrock to the underlying groundwater. The Former Landfill (OU 4) was identified as the source of the TCE and CCl_4 in the groundwater underlying that site. The Schofield Barracks water supply wells are currently extracting groundwater containing TCE and CCl_4 from the groundwater beneath Schofield Barracks (OU 2) and treating the extracted water via air stripping at the Schofield Barracks Water Treatment Plant (WTP) to reduce the TCE and CCl_4 concentrations to EPA MCLs before the water is distributed for human use. The source for the TCE contamination in the Schofield Barracks water supply wells is suspected to be somewhere in the Schofield Barracks East Range, but was not found after extensive investigative effort. This source investigation was performed under the OU1 RI (HLA, 1995b, Section 1.4.1).

1.4.2 Operable Unit 4

OU 4 consists of a former landfill located at Schofield Barracks. The former landfill was constructed in approximately 1942 and remained operational until December 1981. The former landfill encompasses approximately 35 acres, is covered with a soil cap, and does not contain a bottom or top liner system. The landfill contents consist of a variety of solid wastes (primarily domestic waste from base housing), industrial wastes (vehicle and equipment maintenance waste, sewage sludge, solvents, waste), medical wastes, and construction and demolition waste from various military installations on Oahu. In addition, ordnance explosives and unexploded ordnance have been identified in the landfill contents.

1.5 Report Organization

This report documents and evaluates observations and data for OU 2 and OU 4 obtained from historical documents prepared prior to the signing of the RODs, and review of recent regulations, documents, and data collected subsequent to the ROD approval as part of the five-year review. This report is divided into thirteen sections. Section 1.0 presents the purpose and authority for conducting the review, the organizations involved, and definitions of the OUs. Section 2.0 presents the site chronology. Section 3.0 presents background information. Section 4.0 presents the remedial actions taken for each OU. Section 5.0 describes the progress made since the remedy implementation. Section 6.0 presents the five-year review process and its findings. Section 7.0 presents a technical assessment of the review findings. Section 8.0 presents issues associated with each OU and Section 9.0 presents recommend-actions and follow-up actions. Section 10.0 presents protectiveness statements, and Section 11.0 describes the schedule for the next review. Section 12.0 presents references.

2.0 SITE CHRONOLOGY

A chronology of events and public relations activities related to the OU 2 and OU 4 CERCLA programs is presented below. The events and activities listed span the period from the discovery of TCE in groundwater in 1985 until the present.

CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4

Event	Date
Schofield Barracks issued a press release regarding the detection of TCE in the Schofield Barracks Supply wells and the temporary switch to city and county water supplies.	May 1985
Installation of air stripping treatment unit to treat water from Schofield supply wells	September 1986
Schofield Barracks issued a press release regarding the placement of the installation on the NPL.	August 1990
Schofield Barracks Public Affairs Office and Environmental Office addressed the Wahiawa Neighborhood Board regarding Army plans to conduct investigations on Schofield Barracks to identify sources of TCE.	October 1990
A Federal Facility Agreement (FFA) was negotiated among the EPA, the State of Hawaii, and the Army. The FFA identified Schofield Barracks as being under the jurisdiction, custody, or control of the U.S. Department of Defense and subject to the Defense Environmental Restoration Program. Four OUs were defined, including OU 2 (Groundwater) and OU 4 (Former Landfill).	September 1991
The work plan for the Preliminary Assessment/Site Investigation (PA/SI) for OUs 1, 2, and 4 was finalized and the PA/SI for OUs 1, 2, and 4 began.	November 1991
Schofield Barracks and U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) submitted press releases requesting public involvement in locating the source(s) of TCE contamination in and around Schofield Barracks.	January 1992
Schofield Barracks and USATHAMA conducted interviews with twenty local residents to assist in the development of a Community Relations Plan for the Schofield Barracks Installation Restoration Program (IRP).	January 1992
The PA/SI for OU 2 and OU 4 was completed.	May 1992

CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4	
Event	**Date**
The Army finalized the Community Relations Plan for Schofield Barracks and placed copies in the newly established information repositories located in the Mililani Public Library, the Wahiawa Public Library, the Hawaii Department of Health, and the DPW in Building 300 of Wheeler Army Airfield.	June 1992
The work plans for the OU 2 and OU 4 Remedial Investigation/Feasibility Study (RI/FS) were finalized and the OU 2 and OU 4 RIs began.	January 1993
Schofield Barracks and United States Army Environmental Center (now Command) (USAEC) conducted a public meeting at the Hale Koa at Wahiawa District Park in Wahiawa to provide the public with an update on the IRP and the results of the first phase of the investigations.	February 1993
In conjunction with the public meeting, the Army published and distributed a fact sheet that provided an update on the IRP and initial investigative results.	February 1993
Schofield Barracks and USAEC conducted public availability sessions at the Hale Koa at Wahiawa District Park and at the Schofield Barracks Post Library to provide an update on the IRP.	September 1994
In conjunction with the public availability sessions, the Army solicited interest in the formation of a Restoration Advisory Board (RAB) comprised of local citizen representatives, Army representatives, and regulatory agency representatives that would oversee the conduct of the Army's IRP at Schofield Barracks.	September 1994
The Army presented a poster display that summarized installation restoration efforts and plans for Schofield Barracks at the 1st Hawaii National Technologies Conference sponsored by the Hawaii Department of Health.	September 1994
In conjunction with the public availability session, the Army published and distributed a fact sheet that provided an update on the IRP and initial investigative results.	September 1994
The RI/FS for OU 4 was completed.	December 1995
The RI/FS for OU 2 was completed.	February 1996
Schofield Barracks conducted a public review period for the OU 4 Proposed Plan.	April 1996
Schofield Barracks and USAEC conducted a public meeting to present the OU 4 Proposed Plan and solicit public comments.	May 1996
Schofield Barracks conducted a public review period for the OU 2 Proposed Plan.	May 1996
Schofield Barracks and USAEC conducted a public meeting to present the OU 2 Proposed Plan and solicit public comments.	June 1996

CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4	
Event	**Date**
The OU 2 ROD and OU 4 ROD were approved.	September 1996
Submittal of Final Long-term Groundwater (LTGW) Monitoring Plan for OUs 2 and 4	September 1996
Implementation of the OU 2 interim monitoring program	September 1996
Implementation of the OU 2 Long-term Monitoring Program.	April 1997
Implementation of the OU 4 Long-term Monitoring Program	June 1998
Construction for OU 4 remedial action began.	March 1997
Final inspection for OU 4 remedial action was conducted.	July 1998
Schofield Barracks was removed from the NPL.	August 2000
Activities for First Five-Year Review for Schofield Barracks OUs 2 and 4 began.	August 2001
Submittal of Draft First Five-Year Review	December 2001
Approval of First Five-Year Review by Installation Commander	September 2002
Decrease sampling frequency of 13 OU 2 wells to annual and 7 OU 2 wells to semi-annual. Decrease sampling frequency of OU 4 Wells 3103-01, 2903-01, and 3004-05 from semi-annual to annual	October 2002
Decrease sampling frequency of OU 2 Wells 2901-13, 2959-01, 2802-01, and 2803-01 and OU 4 Well 3004-01 to annual	December 2005
Submittal of Addenda to the Final O&M and LTGW Monitoring Plans for OU 2 and OU 4	April 2006
EPA approval of Addenda to the Final O&M and LTGW Monitoring Plans for OU 2 and OU 4	July 2006
Army published and distributed an information sheet providing a general description of the Site and a project summary of remedial measures	July 2006
Army published and distributed a Fact Sheet providing a summary of the results of a reevaluation of groundwater modeling performed as part of the Installation Restoration Program (IRP) at Schofield Barracks	November 2006
Activities for Second Five-Year Review for Schofield Barracks OUs 2 and 4 began.	January 2007

CHRONOLOGY OF SITE EVENTS AND COMMUNITY RELATIONS FOR OU 2 AND OU 4	
Event	**Date**
Submittal of Draft Second Five-Year Review	April 2007
Approval of Second Five-Year Review by Installation Commander	September 2007
Army published solicitations of interest in establishing a Restoration Advisory Board. Insufficient interest was received.	August 2008, April 2010, July 2011
Activities for Third Five-Year Review for Schofield Barracks OUs 2 and 4 began.	March 2012

3.0 BACKGROUND

This section presents descriptions of the physical characteristics, land and resource use, general history and history of CERCLA-related events, and definitions of OUs at Schofield Barracks.

3.1 Physical Characteristics

Schofield Barracks is located in the Schofield Plateau between the Waianae and Koolau Mountain Ranges in central Oahu (Figure 3.1). It is the Army's largest installation outside the continental United States. It currently serves primarily as the home of the 25th Infantry Division, whose mission is to be prepared for deployment to a theater of operations to perform combat operations as part of a corps counterattack. On order, it conducts theater-wide deployment within 54 hours of notification to perform combat operations in support of USCINCPAC theater strategy. In support of this mission, the division's main activity is training. Installation facilities include a medical facility, community and housing support facilities, and transportation and repair facilities.

The groundwater body underlying the Schofield Plateau is known as the Schofield High-level Water Body (Figure 3.2). The water table (potentiometric surface) elevation of the Schofield High-level Water Body is approximately 275 feet above mean sea level. This elevation is lower than the adjacent dike-impounded water bodies to the east (Koolau Mountain Range) and west (Waianae Mountain Range) and higher than the basal water bodies to the north (Waialua Basal Water Body) and south (Honolulu-Pearl Harbor Basal Water Body) that have elevations of less than 50 feet above mean sea level.

The northern and southern boundaries of the Schofield High-level Water Body (characterized as groundwater dams) have been inferred from water-level measurements in domestic and irrigation wells on either side of the groundwater dams and by geophysical surveys. The dams impede groundwater flow to the Honolulu-Pearl Harbor and Waialua Basal Water Bodies. However, the nature and locations of these water body boundaries are not precisely known.

3.2 Land and Resource Use

The property incorporated within the Schofield Barracks Main Post, the Schofield Barracks East Range, and Wheeler Army Airfield are owned and operated by the Army as active military installations. The towns of Wahiawa and Mililani, other military properties, and private properties are adjacent to Schofield Barracks or in the surrounding vicinity. Some of the private properties are used for agricultural purposes such as growing sugar cane and pineapples.

Groundwater is the principal source of drinking water for the population of Oahu and is the source of fresh water for other uses. Most of the groundwater wells in the Schofield Barracks area are used as municipal water supplies or have irrigation uses.

3.3 History of Contamination

Schofield Barracks was originally established in 1908 as a base for the Army's mobile defense of Pearl Harbor and the Island of Oahu. It served as a major support facility during World War II, temporarily housing more than one million troops. It also served as a support and training facility during the Korean and Vietnam wars. Since the Vietnam War, it has served primarily as a training facility.

In 1985, TCE, a commonly used cleaning solvent, was detected in groundwater from the Schofield Barracks water-supply wells. The source of the TCE contamination could not be identified; however, it is likely that the TCE migrated from one or more ground surface locations through the soil and bedrock to the underlying groundwater.

The Former Landfill was an open burn dump from approximately 1942 until 1967, when it was converted to a sanitary landfill in response to provisions of the Clean Air Act (Ecology and Environment, Inc., 1981; Kennedy Engineers, 1980). The Former Landfill was used to dispose of a wide variety of solid wastes from various military installations, of which the major contributors were Schofield Barracks, Wheeler Air Force Base (currently Wheeler Army Airfield), and the Wahiawa Radio Station (U.S. Army Support Command, Hawaii, 1983; Kennedy Engineers, 1980). Most of the waste deposited in the landfill was domestic refuse from the surrounding base housing (Ecology and Environment, Inc., 1981); however, wastes were also disposed from various industrial operations (e.g., vehicle and equipment maintenance and construction). Tripler Army Medical Center (TAMC) reportedly contributed medical wastes including pathogenic, infectious, and pharmaceutical (expired and unusable drugs) wastes (Ecology and Environment, Inc., 1981; Kennedy Engineers, Inc., 1980).

Other materials reportedly disposed in the Former Landfill were organic solvents, sewage sludge, asbestos, pesticide containers, unusable paints, metallic debris, vegetation, and tree stumps (Environmental Science and Engineering, 1984). Hazardous materials, including live munitions, acids, and solvents, were also reported to have been dumped in the landfill (Asquith, 1982; Kennedy Engineers, 1980). HLA personnel interviewed Mr. Steve Kim, Directorate of Health Services, TAMC, on December 6, 1991. Mr. Kim reported that a mortar round and a rocket casing had been excavated from the landfill in the past. Ecology and Environment, Inc., (1981) reported that 90-millimeter (mm) shells exploded onpost when they were struck by a landfill tractor. The EPA Field Investigation Team report (Ecology and Environment, Inc., 1981) cited two explosions of drummed material labeled methyl ethyl ketone, and indicated that an area may exist where 20- to 25-gallon glass containers containing concentrated sulfuric acid are buried. No records were available concerning the types, amounts, or volumes of wastes disposed at the Former Landfill, but the rate has been estimated at 100 tons per day (Kennedy Engineers, 1980).

3.4 Initial Response

In September 1986, the Army installed an air stripping treatment unit to remove the TCE from the water prior to use in the water-supply system. In 1987, EPA established a MCL for TCE of 5 parts per billion (ppb) in drinking water. TCE has not been detected above this limit in the treated groundwater from the Schofield Barracks water-supply wells.

As a result of the detection of TCE in the water from the onpost water-supply wells, Schofield Barracks was placed on the National Priorities List (NPL) in August 1990. The NPL is a list of sites, developed by EPA, which pose a risk to public health or the environment. Section 120 of CERCLA requires federal facilities to investigate and remediate past releases of hazardous wastes that pose a risk.

3.5 Basis for Taking Action

The discovery of the presence of TCE in the Schofield Barracks water supply initiated the CERCLA process at Schofield Barracks. In May 1985, Schofield Barracks issued a press release regarding the detection of TCE in the Schofield Barracks Supply wells and the temporary switch to city and county water supplies. In September 1986 an air stripping treatment unit was installed to treat water from Schofield supply wells. In August 1990, Schofield Barracks issued a press release regarding the placement of the installation on the NPL. A Federal Facility Agreement (FFA) was negotiated among EPA, the State of Hawaii, and the Army in September 1991. The FFA identified Schofield Barracks as being under the jurisdiction, custody, or control of the U.S. Department of Defense and subject to the Defense Environmental Restoration Program. Four OUs were defined, including OU 2 (Groundwater) and OU 4 (Former Landfill).

Groundwater was extensively sampled between 1993 and 1996 during preparation of the Draft Final OU 2 RI Report, Schofield Barracks, (OU 2 RI) (HLA, 1996b) and the Final Feasibility Study Report for OU 2, Schofield Barracks, (OU 2 FS) (HLA, 1996a) to characterize the nature and extent of contamination in groundwater in the Schofield Barracks and Wheeler Army Airfield area. The only analytes detected above MCLs in the groundwater system beneath Schofield Barracks and Wheeler Army Airfield were TCE, CCl_4, antimony, and manganese. Other chlorinated volatile organic compounds (VOCs), such as tetrachloroethene (PCE), were detected in some wells at very low concentrations (less than MCLs). Contaminants were detected in two plume areas: (1) beneath the Former Landfill area and (2) beneath the Schofield Barracks East Range and Wheeler Army Airfield (East Range/Wheeler) area. TCE was the only contaminant detected in the East Range/Wheeler plume area and was also detected in the vicinity of the Former Landfill. In Section 4, Figure 4.3 shows the distribution and concentrations over time of TCE and CCl_4 in onpost wells, and Figure 4.4 shows concentrations over time and the distribution in offpost wells.

The horizontal extent of CCl_4, antimony, and manganese contamination was limited to the immediate vicinity of the Former Landfill. The inorganic analytes antimony and manganese were detected above MCLs inconsistently. Because of this inconsistency and because these inorganic analytes were not detected above MCLs during later RI/FS sampling events, the detections of antimony and manganese above MCLs were believed to be anomalous. Therefore, only TCE and CCl_4 were retained as chemicals addressed in the OU 2 FS.

The results of the OU 4 RI (found in the OU 4 FS) (HLA, 1995a) indicate that TCE and CCl_4 are present within the landfill contents and suggest that they have leached downward to the water table via infiltration and percolation. Thus, the remedial action objectives (RAOs) for OU 4 included controlling this apparent TCE and CCl_4 source by mitigating water infiltration and migration through the landfill contents.

By 1997, the CERCLA process had been completed for the four OUs. OUs 1 and 3 achieved No Further Action status, and remedies were in place for OUs 2 and 4. The remedy for OU 2 consisted of long-term groundwater monitoring combined with wellhead treatment of groundwater used for domestic purposes. The remedy for OU 4 consisted of landfill cover repair and maintenance, landfill gas monitoring, and long-term groundwater monitoring. The completion of remedial construction led to the removal of Schofield Barracks from the NPL in 2000.

4.0 REMEDIAL ACTIONS

This section presents the RAOs and the remedies selected and implemented for OU 2 and OU 4 at Schofield Barracks.

4.1 Operable Unit 2 Remedial Actions

The RAOs and remedy selected and implemented for OU 2 are summarized in the following subsections.

4.1.1 Operable Unit 2 Remedial Action Objectives

The RAOs for OU 2 (HLA, 1996a) are the following:

- Mitigate the risk to human health and the environment from potential exposure to contaminated groundwater.
- Satisfy state and federal Applicable or Relevant and Appropriate Requirements (ARARs).

In the preparation of the OU 2 FS (HLA, 1996a), a comparison between aquifer cleanup and point-of-use groundwater treatment was made. Because of the great depth to groundwater (700 feet or more), it was determined to be impracticable to remediate the water in the Schofield High Level Water Body. A point-of-use treatment approach is feasible and protective because the only route of exposure to water in the aquifer is through withdrawal of the water from wells. It was determined to be cost effective to treat the groundwater at the point of withdrawal for consumptive use. A technical impracticability (TI) waiver was prepared (EPA, 1996), which supports the point-of-use treatment. A TI waiver was necessary for the point-of-use treatment remedy because contaminants will remain in the groundwater at levels of concern for an undetermined period of time. The major provisions of the TI waiver are (1) a groundwater monitoring program is required to assess changing aquifer conditions and to track potential movement of the TCE/carbon tetrachloride plumes, and (2) a site review is required to be conducted once every five years until groundwater remediation goals, which are the Safe Drinking Water Act (SDWA) MCLs, are achieved in the groundwater system. Because of the TI waiver, the cleanup goals apply only at the wellhead and not throughout the aquifer.

4.1.2 Selected Remedy for Operable Unit 2

The selected remedy (HLA, 1996d) provides protection of human health and the environment by reducing potential risks associated with domestic use of the contaminated groundwater. The remedy includes the following components:

- Continue treatment for contaminants of concern (COCs) present in extracted groundwater at the Schofield Barracks Supply Wells and at the water supply system at Kunia Village (Wells 3-2803-05 and 3-2803-07) by air stripping at the wellhead followed by discharge of the treated water to the distribution system.
- The Army must consult with EPA and the State of HDOH prior to abandoning the Schofield Barracks water supply wells, because production at these wells may help to control plume migration.
- Implement long-term sampling and analysis of water supply wells, agricultural wells, and monitoring wells in the region. The monitoring well network for the long-term monitoring program is shown in Table 4.1.
- Implement the contingency of wellhead treatment on any water supply wells that are impacted by the plume from Schofield Barracks at concentrations above one-half of the MCL as established under the SDWA. The evaluation process for implementing treatment is illustrated in Figure 4.1.
- Upgrade the treatment system or pay any incremental costs for treatment caused by contamination from Schofield Barracks at wells that already have a treatment system in place.
- Conduct five-year site reviews with HDOH and EPA to ensure that human health and the environment continue to be protected.

HDOH requires that any new wells installed as water-supply wells under SDWA be sampled for the SDWA-specified analytes, which include TCE and CCl_4. New water-supply wells that are installed within the area covered by the long-term monitoring network will be added to the existing long-term monitoring network (Table 4.1). Should these new wells be or become contaminated with COCs at the trigger concentrations described in Figure 4.1, and the contamination be shown to be directly attributed to Schofield Barracks, the selected wellhead treatment alternative would be implemented to address this contamination. The purpose of the groundwater monitoring portion of the selected remedy is to assess groundwater conditions and to track the movement of the TCE and CCl_4 plumes to provide an early warning of potential contamination and to assess whether wellhead treatment is warranted (Figure 4.1).

The State Water Code, Chapter 174C HRS, Section 174C-82, states powers and duties of the Commission on Water Resource Management. These powers and duties included requiring that all wells are registered, requiring permits for well construction and pumps and pumping equipment, and requiring well completion reports. Section 174C-83 states that any person owning or operating any well shall register the well with the commission. For new wells, no well construction and no installation of pumps and pumping equipment shall commence without an appropriate permit from the commission. During annual monitoring reviews, Department of Land and Natural Resources (DLNR) will be contacted to see if permits for any new wells have been issued since the previous five-year review.

All public water supply wells are sampled for a broad suite of analytical parameters on a regular basis, and results are reported to the Safe Drinking Water Branch. The contaminants of concern for Schofield Barracks OU 2, TCE and CCl_4, are included in the analytical suite. Examples of public water supply wells are the Schofield Barracks shaft supply wells and the Wahiawa and Mililani municipal wells, all of which are also sampled as part of the OU 2 long-term monitoring program. Although owners of private wells are not required to test the water from their wells, private well owners are warned by the commission that water from their wells should not be considered safe to drink unless it is tested first. Suggested parameters for testing are listed in a handout downloadable from the HDOH website. The parameters include organics, and owners are referred to an EPA website for the complete list of suggested parameters. Private well owners such as Kunia Village conduct their own ongoing monitoring programs.

Additional coordination between HDOH, DLNR and USAG-HI DPW Environmental should be established when a new well application is received within a specified geographic area where groundwater impacts exist, so those applicants can be notified, and their wells sampled as necessary. This approach has been outlined to HDOH and details are being formalized. The details of the long-term groundwater monitoring plan, evaluation process for implementation of wellhead treatment, and description of conditions at existing water wells are presented in the OU 2 Operation and Maintenance Plan (HLA, 1996e).

4.1.3 Operable Unit 2 Remedy Implementation

The OU 2 selected remedy was implemented immediately following the OU 2 ROD (HLA, 1996d) approval. Wellhead treatment via air stripping continued at the Schofield Barracks WTP and at Kunia Village (formerly owned by Del Monte) Wells 3-2803-05 and 3-2803-07. Additionally, after approval of the OU 2 ROD, the Army reimbursed Del Monte for the capital cost of the air stripping tower and began reimbursing Del Monte for costs associated with operating the air stripper that treats groundwater from Well 3-2803-05 and 3-2803-07 and provides a drinking water supply for Kunia Village. No additional wells have required treatment since that time until the installation of the Sandwich Isles Communications well (Section 4.1.4.4) An interim long-term monitoring program was conducted from September 1996 through

January 1997. The long-term monitoring program for OU 2 was implemented in April 1997 and continues to the present (2012).

4.1.4 Operable Unit 2 System Operations and Maintenance

The OU 2 remedy components that are currently being implemented are long-term groundwater monitoring, wellhead treatment of groundwater at the Schofield Barracks WTP, and wellhead treatment at Kunia Village Well 3-2803-05. The components of the OU 2 remedy that incur O&M costs are the following:

- Long-term groundwater monitoring program implementation
- Schofield Barracks groundwater treatment system operation
- Kunia Village air stripper system O&M
- Sandwich Isles Communications (SIC) air stripper system.

O&M activities are described below and associated costs for each of these activities are summarized in Table 4.2.

4.1.4.1 Long-term Groundwater Monitoring Program

The long-term monitoring program incorporates a network of wells (Table 4.1) that includes onpost monitoring wells, the Schofield Barracks water supply wells, and offpost domestic/ municipal and irrigation wells. These wells were initially sampled either quarterly or semiannually, as specified in the OU 2 O&M Plan (HLA, 1996e). Based on continuing evaluations of contaminant concentrations in these wells using the evaluation method shown in Figure 4.2, the monitoring frequency for some wells was reduced in May 2002 and again in December 2005. The initial monitoring frequency and changes implemented since 2007 are shown in Table 4.3. Currently, two wells are sampled quarterly, eight semiannually, and 22 annually. The current monitoring frequency for each well is presented in the right column of

Table 4.3. Groundwater samples are analyzed for TCE and CCl_4, and monitoring reports presenting the results are prepared semiannually.

As part of the monitoring program, the eleven onpost monitoring wells require routine maintenance, which has included pump and wiring repair or replacement for most of the wells. Total yearly costs for fiscal years 2007 through 2011 for the long-term groundwater monitoring program are presented in Table 4.2.

4.1.4.2 Schofield Barracks Water Treatment Plant Operation and Maintenance

The Schofield Barracks WTP is designed to remove TCE and PCE from groundwater by air stripping treatment before distribution of the groundwater to the public. The Schofield Barracks WTP consists primarily of five packed air stripping towers (one remains on standby), four extraction wells (one remains on standby), a chlorination system, a fluorination system, process pumps, groundwater extraction pumps, process controls and instrumentation, piping and associated appurtenances. A complete description of the overall treatment plant equipment and its subsystems with respect to design parameters, operations, and maintenance are provided in Appendix A.

O&M is performed by Schofield Barracks personnel and primarily consists of replacement of bag filters every two weeks, wash down of one packed air stripper tower weekly, replacement of flow meters and flow sensors, as needed, one operator checking the plant operation daily, and quarterly influent and effluent WTP water sampling. The associated annual O&M costs for the WTP incurred for fiscal years 2007 through 2011 were not known to personnel interviewed for this five-year review.

4.1.4.3 Kunia Village Air Stripper Treatment System Operation and Maintenance

The Kunia Village Air Stripper Treatment System (ASTS) is designed to remove TCE and CCl_4 from groundwater extracted from Well 3-2803-05 by air stripping treatment before distribution of the groundwater to the Kunia Village water supply. The Kunia Village ASTS consists primarily of one air stripping tower, one extraction well, one process pump, one groundwater extraction pump, process control and instrumentation, piping and associated appurtenances.

O&M is performed by Kunia Village and associated costs are reimbursed by the Army. The costs reimbursed to date are those for air stripper tower installation, blower replacement, and routine O&M. The reimbursed total cost provided to Kunia Village by Schofield Barracks is presented in Table 4.2.

4.1.4.4 Sandwich Isles Communications (SIC) Air Stripper Treatment System Operation and Maintenance

Sandwich Isles Communications (SIC) installed a water supply well for agricultural purposes at a 162-acre site at Waipio Acres. SIC has acquired a pump installation permit from the State of Hawaii Department of Land and Natural Resources to install a permanent deep well pump. In 2005, an exploratory well (SIC-01) (Well 3-2801-03) was constructed to serve as a primary source of irrigation water for the site. The groundwater was sampled and was found to be contaminated with TCE at a level of 66 micrograms per liter (µg/L) based on the *Results of Drilling and Testing Report for the SIC-01 Exploratory Well* (Water Resources Associated (September 2005). Citing the Final ROD for OU 2, SIC requested assistance from the Army in treating the groundwater. The Army agreed to implement the contingency of wellhead treatment on any water supply wells that are impacted by the plume from Schofield Barracks above one-half of the MCL of 5 µg/L.

The SIC ASTS was designed and installed by Greenwave Solutions, Inc. (GreenWave) to remove TCE to below one-half of the MCL for TCE in drinking water (2.5 µg/L). The system was installed in 2011 and operations began 17 February 2012. The system includes two (2) air stripping towers along with its associated air blowers; a generator building housing a back-up generator, electrical panels, and chorine disinfection unit; a Granular Activated Carbon (GAC) air scrubber; a deep well pump; a transfer pump with wet well; and a water storage tank. The system description for the SIC ASTS is included in Appendix A. Currently the well is being sampled quarterly as part of its initial start-up procedures.

The ongoing O&M activities being performed are in accordance with the OU 2 O&M Plan (HLA, 1996e) and are successfully meeting the requirements stated in the OU 2 ROD.

4.2 Operable Unit 4 Remedial Actions

This section presents a summary of RAOs and remedy selection and implementation for OU 4.

4.2.1 Operable Unit 4 Remedial Action Objectives

The following RAOs were selected from EPA's Presumptive Remedy for CERCLA Municipal Landfill Sites guidance document (EPA, 1993) to provide protection to human health and the environment for the media of concern identified in the OU 4 ROD (HLA, 1996c), which include landfill contents and landfill gas.

- Prevent direct contact with landfill contents.
- Reduce contaminant transport to groundwater.
- Control surface-water runoff and erosion.
- Control landfill gas.

4.2.2 Selected Remedy for Operable Unit 4

The selected remedy provides protection of human health and the environment by reducing potential risks associated with direct contact of the landfill contents and potential transport of contaminants to groundwater. The remedy includes the following major components:

- Regrade the existing landfill cover to generally match the 1983 engineered drainage grade.
- Remove the existing Guinea grass and revegetate with another type of grass that is more appropriate for a landfill cover.
- Perform long-term maintenance of the landfill cover.
- Maintain existing landfill gas venting.
- Install additional gas monitoring points at the perimeter of the landfill.
- Implement institutional controls (landfill gas and groundwater monitoring, five-year site review, land-use restrictions, and site security). The existing institutional controls include prohibitions on the use or disturbance of groundwater, prohibitions on excavation activities, disturbance of the landfill cover, and any other activities that might interfere with the implemented remedy.

4.2.3 Operable Unit 4 Remedy Implementation

Implementation of the selected remedy began on 10 March 1997 and occurred in several different construction phases. The final inspection was performed on 21 July 1998. Landscaping activities were completed on 7 August 1998. Remedial activities consisted of the following:

- Clearing and grubbing of existing vegetation and selected trees and shrubbery
- Repairing landfill cracks
- Filling of landfill subsidence areas
- Regrading the surface of the landfill cover to maintain a positive slope to promote surface water runoff
- Landscaping with new vegetation

- Repairing a portion of the existing central drainage system
- Repairing eroded areas on the sides of the existing central drainage system
- Installing a cement rubble masonry (CRM) channel
- Installing nine new gas monitoring wells and modifying five existing monitoring wells

Upon completion of remedial activities, EPA determined that the landfill cap, drainage and monitoring systems were complete, functional, and operational.

4.2.4 Operable Unit 4 System Operations and Maintenance

O&M of the landfill includes maintenance of the cover and long-term monitoring of perimeter landfill gas wells. The purpose of maintenance of the landfill cover is to ensure continued performance of the remedial action. O&M of the landfill cover was conducted in general accordance with the OU 4 O&M Plan (HLA, 1996f). O&M requirements include general inspection requirements, general maintenance requirements, long-term monitoring, recordkeeping, and reporting.

General inspection requirements include quarterly inspections of the landfill cover, vegetative cover, side slopes, drainage system, existing landfill gas wells, perimeter landfill gas monitoring system, groundwater monitoring well network, security fence, access roads, and survey monuments. The OU 4 O&M Plan (HLA, 1996f) also requires additional inspections of the landfill cover, side slopes, and drainage system after heavy rainfall events and after major storm or earthquake events.

Following are general maintenance requirements for the different components of OU 4:

- Vegetative Cover: Conducting perimeter control and spot control to prevent reinvasion of Guinea grass and other undesirable vegetative species and annual mowing of the vegetative cover.

- Side Slopes: Backfilling with topsoil and compacting damaged areas to the final grade. Placing erosion matting in areas where erosion or slumping is persistent until vegetation is adequately established.
- Drainage System: Repairing any structures found to be damaged, clogged, or incapable of conveying runoff flows.

Any damaged perimeter landfill gas monitoring wells, existing landfill gas wells, and groundwater monitoring wells are required to be repaired or replaced accordingly. In addition, any damaged security fences, access roads, and survey monuments are required to be repaired immediately.

Long-term monitoring for OU 4 originally included monitoring of the perimeter landfill gas wells to confirm that Hawaii State regulations requiring that landfill gas not exceed the lower explosive limit (LEL) at the landfill boundary were met. However, because this concentration requirement was met for a number of years, the requirement for continued gas monitoring was eliminated during the Second Five-Year Review (ECC and MACTEC, 2007a).

O&M costs for the OU 4 remedy include landfill gas monitoring (now discontinued), landfill landscaping (re-grading, application of herbicide to remove Guinea grass, etc.), landfill cover crack repair (from settlement and desiccation), and repair/replacement of any other damaged component listed above. The annual O&M costs incurred during fiscal years 2007 through 2011 for landfill cap maintenance and landfill gas monitoring are presented in Table 4.4. As shown in Table 4.4, the most significant cost is due to landfill O&M, which primarily consists of cover crack repair. The cost of landfill landscaping has also been substantial due to revegetation of the regraded area. Because landfill gas monitoring is performed as routine maintenance, the associated cost has been relatively consistent. The ongoing OU 4 O&M activities being performed by Schofield Barracks are in accordance with the OU 4 O&M Plan (HLA, 1996f) and are successfully meeting the requirements stated in the OU 4 ROD.

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

The first five-year review for Schofield Barracks covered the period from March 1997 through September 2001. The second five-year review covered the period from October 2001 through December 2006. Therefore, this third five-year review covers progress since the last five-year review period (i.e., January 2007 through December 2011). Progress for OU 2 and OU 4 are discussed separately in the following subsections.

5.1 Progress for Operable Unit 2

The following subsections provide discussions of the protectiveness statements from the first and second five-year reviews, the status of recommendations and follow-up actions made in the second five-year review, and the results of implemented actions.

5.1.1 Protectiveness Statements from Second Five-Year Review

The second five-year review stated that the remedy for OU 2 was functioning as intended by the OU 2 ROD and that the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection were still valid. One issue was identified that could impact the protectiveness of the remedy; TCE concentrations exceeded the action level of 2.5 µg/L in groundwater samples from Well 3-2803-01. Although this well was classified as a domestic/municipal use well, it was reported by DPW that the well was only used as a source for process water for the Kunia Tunnel cooling towers. Because Kunia Village's water was available to the U.S. Department of the Navy (Navy) in case of an emergency, there would never be a time when this well would be used for domestic purposes. Therefore, the remedy was deemed to be effective and protective. It was found that this well was misidentified and is actually Well 3-2803-03 according to DLNR records. This well is classified as industrial by DLNR. Therefore, the TCE concentrations in this well do not affect the protectiveness of the remedy and treatment is not necessary. The re-classification of use recommended in the Second Five-year Review was found to be unnecessary.

5.1.2 Status of Recommendations and Follow-up Actions from Second Five-Year Review

The recommendations for OU 2 from the Second Five-Year Review Report (ECC and MACTEC, 2007a) and follow-up actions for each are discussed in this section.

The pump in Monitoring Well MW 2-1 (3-2900-02) was repaired on 3 May 2007.

These repairs restored the well to service for sample collection.

Monitor the TCE concentrations in Well 3-3004-01 to assess increasing the monitoring frequency if the concentration reaches 30 µg/L.

The TCE concentration has been monitored over time, but the increasing trend did not continue. The monitoring frequency remains at annual.

Correct the name of Well 3-2803-01 to 3-2803-03 in future sampling events and in the database.

The Well ID remains unchanged as 3-2803-01 to be consistent with previous reports. However, the well name 3-2803-03 is used in this report.

Developed a contingency plan for monitoring all wells in the long-term groundwater monitoring program.

The plan is presented in Section 9, Table 9.1. A summary of the changes in the monitoring frequency of wells in the long-term monitoring program is provided in Table 4.3.

5.1.3 Results of Implemented Actions

The results of the implemented actions are as follows:

Well Repairs

The onpost monitoring wells have been maintained in good condition after repairs were completed. Onpost monitoring wells that were repaired during the third Five Year Review period are following:

Repairs to Onpost Wells in Monitoring Network

Well	***Repair***	***Date***
MW 2-1	Replaced Pump	May 2007
MW 2-6	Replaced Discharge Pipe	August 2009
MW 2-4	Replaced Pump, Motor, Discharge Pipe	October 2010

Classification Change of Kunia Village Well 3-2803-01

As described in Section 5.1.2, the classification change to industrial was not approved by DOH. However, it was found that this well is actually Well 3-2803-03, which is already classified as industrial. Therefore, no further action was required regarding this well. The site identification for this well has not been changed in the ERIS database to minimize confusion. The Well ID remains unchanged as 3-2803-01 to be consistent with previous reports. However, the well name 3-2803-03 is used in this report.

Changes in Groundwater Monitoring Frequency

The monitoring frequencies for the wells in the monitoring network were evaluated in every semiannual and annual report. Based on changes in concentration over time, frequencies were recommended for decrease or increase based on the logic diagrams presented in Figures 4.1 and 4.2. Current monitoring frequencies as of the 2011 Annual Report are presented in Table

4.3, and no changes to these monitoring frequencies are proposed. Currently two wells are monitored quarterly, eight wells are monitored semiannually, and 22 are monitored annually.

5.2 Progress for Operable Unit 4

The following subsections provide discussions of the protectiveness statements from the second Five-Year Review Report, the status of recommendations and follow-up actions made in the first five-year review, and the results of implemented actions.

5.2.1 Protectiveness Statements from Second Five-Year Review

The first and second Five-Year Review Reports (Harding ESE, 2002; ECC and MACTEC, 2007a) stated that the OU 4 remedy was functioning as intended and would continue to improve groundwater conditions provided that continued maintenance and repair are performed on the landfill cover. The existing institutional controls were effective in prohibiting the use or disturbance of groundwater, excavation activities, disturbance of the cover, or other activities that might interfere with the implemented remedy. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy implementation were valid. Based on the available data at the time of the Second Five-Year Review, the remedy was considered to be effective and protective with continued maintenance and repair.

5.2.2 Status of Recommendations and Follow-up Actions from Second Five Year Review and Results

This section presents a discussion of the recommendations for OU 4 made in the Second Five-Year Review Report (ECC and MACTEC, 2007a) and follow-up actions taken to implement these recommendations:

Repair the cracks in the landfill cover when they are observed.

Repairs to the landfill cover and surface features have been made on a regular basis in response to conditions observed during quarterly landfill physical inspections. This included crack repairs as presented in Section 6, Table 6.5. Additionally, soil moisture is kept a relatively consistent level through the use of a sprinkler system, and monitored through the use of soil moisture sensors (see Appendix I, Photos 23 and 24).

Take measures to address the slight erosion and cracked concrete evident in the Center Drainage Channel of the landfill. The cracked concrete should be repaired, and recommendations for addressing the erosion include one of the following: (1) regrading/revegetating, (2) installment of permanent erosion matting, or (3) placement of riprap along affected areas.

The cracked concrete in the Center Drainage Channel was repaired and erosion control matting was replaced as described in Section 6 and presented in Table 6.5. Routine maintenance typically includes either riprap repair or fabric replacement at least once a year. In addition to routine maintenance, a major drainage repair was conducted in 2010 (ECC, 2010) because a large rainfall event severely eroded the Central Drainage Channel. This major repair is further discussed in Section 6.

Repair any corroded protective surface housings for the four groundwater monitoring wells at the landfill.

The Site Inspection for the landfill showed that only minor corrosion on the well covers has occurred since 2007. Some minor maintenance of well covers and locks was needed to secure some of the wells, as presented in Appendix F, Table F.2.

Remove new small trees growing on the cap. Note that this does not include the large, 20-25 year old tree near the northwest perimeter of the landfill. A decision was made, with the concurrence of the Army, to leave the large tree.

New small trees are removed as part of regular maintenance.

Manage growth of Guinea grass and other invasive weeds on previously cleared side slopes and cap with herbicides, followed by revegetation with native grasses or using procedures that are in accordance with the O&M plan.

The landfill cover consists mainly of grasses that are maintained at a low height. Soil moisture is kept a relatively consistent level through the use of a sprinkler system, and monitored through the use of soil moisture sensors. Vegetative cover height is maintained through periodic mowing.

Fill in eroded areas under fence with soil or rock and remove trees entangled in the fence.

This activity has been done as part of regular maintenance in response to quarterly physical inspections.

Fill in eroded areas around the concrete footings of fence posts, and replace or repair damaged post.

This activity has been done as part of regular maintenance in response to quarterly physical inspections.

6.0 FIVE-YEAR REVIEW PROCESS AND FINDINGS

The five-year review process consists of several components, including document and data review and evaluation, site inspections, and community involvement activities. This section presents discussions of each of these process components and the findings of the review. EPA Region 9 was notified about the initiation of the third five-year review in February 2012. The Army's five-year review team included Ms. Carrie Nelson, IRP and MMRP Program Manager of Schofield Barracks DPW and Ms. Jenny Lai, IRP and MMRP Program Assistant. Mr. Mark Ripperda represents EPA Region 9 and Mr. Steven Mow represents DOH.

Components of the five-year review process include the following:

- Historical and Recent Document Review and Findings
- Data Review and Evaluation
- Remedy Inspections and Findings
- Community Relations

The following subsections describe the document and data review and evaluation, relevant inspections, findings for OUs 2 and 4, and the public involvement components for both OUs.

6.1 Operable Unit 2 Document and Data Review and Findings

Historical documents relevant to the Schofield Barracks CERCLA process and documents produced and data collected for OU 2 over the past five years were reviewed as a part of this five-year review process. A list of these documents is presented in Appendix B, and discussions of the review and findings are presented in the following subsections.

6.1.1 Operable Unit 2 Historical Document Review

Documents relevant to the CERCLA process, including the ROD (HLA, 1996d), the Comprehensive Five-Year Review Guidance (EPA, 2001), and the OU 2 O&M Plan (HLA, 1996e) were reviewed as part of this five-year review. The following subsections present discussions of the review of each of these documents in the context of remedy compliance.

6.1.1.1 Operable Unit 2 Record of Decision

The OU 2 ROD (HLA, 1996d) documents the selected remedy, summarizes the rationale for remedy selection, identifies ARARs, and documents other aspects of the decision. The document and the Second Five-Year Review Report (ECC and MACTEC, 2007a) were reviewed to ensure that the remedy remains in compliance with the ROD and to assess whether any ARARs presented in the ROD have been revised, replaced, or deleted in the past five years. No change to the ARARs was found that differs from the ARARs review discussion in the Second Five Year Review. The ARARs tables presented in the OU 2 ROD (ROD Tables 2.2 and 2.3) are presented in Appendix C of this report and any changes to the regulations comprising the ARARs have been noted.

A summary of OU 2 ARARs changes is as follows:

- Location-Specific ARARs
  - Several ARAR citations have been corrected from Hawaii Administrative Rules (HAR) to Hawaii Revised Statutes (HRS).
  - 50 CFR 227, which relates to threatened or endangered habitat, was deleted from the CFR as of October 1, 1999.
- Action-Specific ARARs
  - HAR 11-60.1-68, related to air stripper emissions, was modified but is still applicable.

The updated location-, chemical-, and action-specific ARARs are listed below. The text is shown in italic type where ARARs have been revised from those stated in the ROD:

- Location-specific ARARs:
  - 16 United States Code (USC) 661 et seq., 662 and 663, requiring actions to be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources.
  - *Clean Water Act (CWA) 404, 33 CFR 320-330, and 40 CFR 230, prohibiting discharges that cause or contribute to significant degradation of the water of ecosystems.*
  - HAR 183D-61 et seq., prohibiting interference with wild birds or their nests.
  - CWA 404, prohibiting the discharge of fill material into aquatic ecosystems that would jeopardize endangered, threatened, or rare species.
  - *HAR 194D-4, 16 USC 1531 et seq., 50 CFR 402 prohibiting actions that jeopardize endangered or threatened species or critical habitat of such species as designated in 50 CFR 17 or 50 CFR 226. 50 CFR 227 was deleted on October 1, 1999.*
- Chemical-specific ARARs
  - *40 CFR Part 141.2, defining SDWA MCLs and maximum contaminant level goals (MCLGs).*
  - *40 CFR 141.50, listing MCLGs for organic contaminants.*
  - *40 CFR 141.61, listing MCLs for organic contaminants.*
  - *2012 Edition of the Drinking Water Standards and Health Advisories, EPA 822-S-12-001, April 2012.*
- Action-specific ARARs:
  - HAR 11-60.1-33(a)(1)-(7) and (b), prohibiting the discharge of visible fugitive dust emissions beyond the property lot line on which the dust originates and requiring precautions to prevent fugitive dust emissions.
  - *HAR 11-60.1-68, requiring monitoring of VOC emissions if emissions are greater than 0.1 ton per year for each hazardous air pollutant.*
  - 40 CFR Part 141, Subparts B and G, defining MCLs.

6.1.1.2 Five-Year Review Guidance Document

The Five-Year Review Guidance document (EPA, 2001) was reviewed to ensure that the review process and reporting are in compliance with the guidance document.

6.1.1.3 Operation and Maintenance and Long-Term Groundwater Monitoring Plan

The OU 2 O&M Plan (HLA, 1996e) documents the long-term monitoring program, sampling and analysis procedures, contingencies for revising the program, O&M requirements, and reporting requirements. The O&M Plan was reviewed to ensure that each of these items is being conducted in compliance with the plan. Important items discussed in the O&M plan are the monitoring well network, sampling frequencies, and contingencies for applying wellhead treatment. Wells in the monitoring well network are summarized in Table 4.1 and their locations are shown in Figure 4.3. The procedural diagrams for changing monitoring frequency for a well, or for applying wellhead treatment based on changing COC concentrations, are presented in Figures 4.1 and 4.2. Review of the O&M Plan indicated that the monitoring program is being conducted in compliance with the plan.

During the Second Five-Year Review, three minor revisions were proposed to the OU 2 O&M Plan (Section 2.1.4.2) (HLA, 1996) and OU 4 O&M Plan (Section 6.1.2.4) (HLA, 1996). These revisions relate to sample handling and shipping and are the result of changes in sampling guidance by EPA since the O&M Plans were prepared:

1. Updated guidance (EPA, 2004) states that water samples collected for volatiles analysis should be filled to capacity with no air bubbles, preserved to a pH of 2 with HCl, and cooled to 4 ^{o}C (plus or minus 2 ^{o}C) immediately after sample collection.
2. Samples must be shipped as soon as possible, preferably on the same day as sample collection to avoid exceeding sample holding times. If overnight transit is not possible, samples should be maintained at 2 to 4 ^{o}C until they are shipped to the laboratory (EPA, 2004).

3. Samples that are preserved with HCl must be analyzed within 14 days of sample collection. Water samples that have not been maintained at a temperature of 4 ^{o}C (plus or minus 2 ^{o}C) and preserved to a pH of 2 or below should be analyzed within 7 days from sample collection (EPA, 1999). Given that the water samples are for long-term monitoring purposes only, water samples that are received by the laboratory at a temperature exceeding 4 ^{o}C will be noted as having an elevated temperature. These changes were approved in the Second Five-Year Review and were implemented during the Third Five Year Review period.

6.1.2 Operable Unit 2 Recent Document Review, Data Evaluation, and Findings

OU 2 documents reviewed for the past five years include quarterly groundwater monitoring reports, regulatory correspondence, and solicitations for establishing Restoration Advisory Boards (RABs). The following subsections present discussions of the review of each of these reports and documents, and the resulting findings.

6.1.2.1 Review of Quarterly Groundwater Monitoring Reports and Analytical Data Evaluation

Groundwater monitoring was performed for a subset of wells each quarterly, semiannual, or annual sampling event, in general accordance with the O&M Plans (HLA, 1996e,f) and Addenda to the Plans (Versar, 2006). The groundwater sampling events performed during the five-year review period are shown in Table 6.1. The current monitoring well network and the monitoring frequency for each well are shown in Table 6.2. The approximate TCE plume boundary is shown by the 5 µg/L isoconcentration line shown in Figure 6.1. Groundwater monitoring reports prepared for each of these events were examined as part of the document review. The historical chemical data were also evaluated to assess trends in concentrations over the past five years. The results of the report review and data evaluation are presented in this subsection.

Deviations from the O&M Plans (HLA, 1996e, f) included a reduced monitoring round during the first quarter of FY2011 (Round 57) because of contractual issues. Table 6.3 summarizes the wells designated for sampling, but not sampled during the five-year review period. For most of these wells, the pumps were non-functional and required repair. There were also several wells that were not available for sampling due to access limitations.

During the Rounds 56, 58, and 60 sampling events, the sample collection method for the four onsite supply wells (3-2901-02, 3-2901-03, 3-2901-04, and 3-2901-10) was not consistent with the rounds previous to Round 56 because the cart used to access the shaft wells was not in passenger mode. Instead, each of the four sampled supply wells was run separately and the water was sampled from a port on the production pipe at the ground surface before it entered the treatment plant. The analytical results for these wells from these sampling rounds were generally consistent with previous results from the wells. As part of the Second Five-Year Review, the Army developed a contingency plan for sampling all wells specified in the OU 2 and OU 4 O&M Plans (HLA, 1996e, f). This plan is presented in Section 9.1.2 of this report.

Time versus concentration plots were developed for each well based on data collected between 1993 and December 2011. These graphs, presented in Appendix D, were used to evaluate trends in concentration for each well in the groundwater monitoring network. Time versus concentration graphs for individual wells are also shown in map view in Figures 4.3 and 4.4. Table 6.2 presents the detailed TCE and CCl_4 trend analyses for each of these wells. Based on the monitoring reports and the trend evaluation, the distribution of contaminants in groundwater has remained stable over the past five years. Some wells have shown slightly increasing trends in TCE or CCl_4, or both. Other wells have exhibited slightly decreasing trends. The following is a summary of conclusions regarding the analytical data from the quarterly reports reviewed and the trend analyses and evaluation:

Monitoring Well 3-2702-05:
- TCE concentration data suggest a gradual increasing trend from August 2009 to the present (≥2.5 μg/L)

Monitoring Well 3-2801-02 (MW-2-4):
- TCE concentration data suggest a gradual decreasing trend until August 2009, but slight increasing trend from August 2009 to the present.

Monitoring Well 3-2802-01 (MW-2-6):
- TCE concentration data suggest a gradual increasing trend from August 2009 to the present.

Monitoring Well 3-2803-07:
- TCE concentration data suggest a gradual increasing trend from 2005 to August 2009, but appears to be on a decreasing trend from 2009 to the present.

Monitoring Well 3-2900-02 (MW-2-1):
- TCE concentration data suggest a gradual increasing trend from August 2009 to the present.

Monitoring Well 3-2901-02 (Supply Well 1):
- TCE concentration data suggest a gradual increasing trend from 1996 to the present.

Monitoring Well 3-2901-03 (Supply Well 2):
- TCE concentration data suggest a gradual increasing trend from 1996 to the present.

Monitoring Well 3-2901-04 (Supply Well 3):
- TCE concentration data suggest a gradual increasing trend from 1996 to the present.

Monitoring Well 3-2901-10 (Supply Well 4):
- TCE concentration data suggest a generally stable, but slightly increasing trend from 1996 to the present.

Monitoring Well 3-2901-13 (MW-1-1)
- TCE concentration data suggest an overall stable trend with occasional slight increases and decreases from 1994 to the present.

Monitoring Well 3-2902-03 (MW-2-3):
- TCE concentration data suggest a gradual decreasing trend overall from 1995 to the present.

Monitoring Well 3-3004-03:
- TCE concentration data suggest increased from approximately 10 μg/L to approximately 20 μg/L from 1994 through January 2007. From January 2007 to present the TCE concentration data suggest a stable to slightly decreasing trend.

Monitoring Well 3-3004-04:
- TCE concentration data increased from approximately 15 μg/L to 27.2 μg/L from 1995 to 1998.

- TCE concentration data suggest a stable trend from 1998 to the present.

Monitoring Well 3-3004-05:
- TCE concentration data have increased from approximately 1.1 µg/L to approximately 2.4 µg/L from 2003 through 2006.
- TCE concentration data suggest a gradual decreasing trend from 2006 to the present.

Consistent with analytical results since 1993, CCl_4 concentrations for OU 2 monitoring and water-supply wells were below the MCL of 5 µg/L and less than half the MCL.

Consistent with analytical results since 2000, CCl_4 concentrations for OU 4 wells were below the MCL of 5 µg/L.

Three onsite OU 4 monitoring wells, Wells 3-3004-01 (MW-4-1), 3-3004-03 (MW-4-3), and 3-3004-04 (MW-4-4) have CCl_4 concentrations above half the MCL of 2.5 µg/L. Well 3-3004-01 (MW-4-1) has shown a decreasing trend since 1995.

6.1.2.2 Regulatory Correspondence

Correspondence from EPA and/or HDOH for the time period 2007 to 2011 include comments based on reviews of groundwater monitoring reports. The following were of note in correspondence from these regulatory agencies.

- In a letter dated 24 August 2007, HDOH concurred with the Army recommendation to discontinue landfill gas monitoring that was presented in the May 2007 long-term monitoring report (ECC and MACTEC, 2007b). In this same letter, HDOH concurred with the recommendation to decrease sampling frequency for four monitoring wells (3-2803-07 [Kunia Village #4], 3-2902-03 [MW2-3], 3-2801-02 [MW2-4], and 3-2900-02 [MW2-1]) from semiannual to annual.

- In a letter dated 18 January 2008, HDOH provisionally concurred with the recommendation to reduce the reporting of groundwater monitoring results from quarterly to semiannually. However, if anomalous increases in groundwater concentrations are observed, a return to quarterly reporting will be required.

6.1.2.3 New Wells in the Monitoring Network Area

The DLNR Commission on Water Resource Management (CWRM) was contacted in April 2012 to determine if new wells had been installed in the Schofield Barracks monitoring area network. A search conducted by DLNR for wells issued Pump Installation Permits (PIPs) after completion of the second Five-Year Review revealed six potentially new wells in the monitoring network area. As a result of these findings, four of the six wells have been identified as possible additions to the monitoring network area for evaluation of groundwater conditions in the vicinity of Schofield Barracks. The locations of these wells are presented in Figure 6.1 along with the locations of the original wells in the monitoring network area. Specific details concerning each of the new wells are presented in Table 6.4 and outlined below:

- **Sandwich Isle Communications (SIC) Well No. 3-2801-03:** In 2005, SIC constructed an exploratory well to serve as the primary source of irrigation water for a 162-acre property. Groundwater from the well was sampled and found to be contaminated with TCE at 66 µg/L, exceeding the maximum contaminant level of 5 µg/L. With the assistance of the US Army Garrison, Hawaii, SIC constructed an Air Stripping System to remove the TCE contamination. This well is new since the previous Five-Year Review and is recommended for addition to the monitoring network.

- **Alii Turf Co., LLC Well No. 3-3001-01:** This well was approved for a PIP in 2010 to provide the primary water source for agricultural endeavors on a 68-acre property. Proposed uses for the property include a dry litter hog operation, banana cultivation and turf grass production. This well is new since the previous Five-Year Review and is recommended to be evaluated for possible addition to the monitoring network.

- **U.S. NAVFAC Hawaii Well No. 3-3100-02:** This well was originally drilled in 1942 and is already included in the monitoring network area. A new PIP was issued for this well in 2009 for refurbishment purposes.

- **Hakerley Waialua Well No. 3-3104-01:** This well was approved for a PIP in 2007 for the purpose of providing domestic and irrigation water for a privately owned parcel. However, the PIP expired on 20 February 2011 and evidence suggests that the well was never constructed on the subject property.

- **Hawaiian Earth Products Well No. 3-3104-02:** This well was approved for a PIP in 2010 for the purpose of providing potable ground water for a composting facility situated on 100 acres. The proposed uses for the water include agricultural, industrial, landscape irrigation, and domestic demand. This well is new since the previous Five-Year Review and is recommended to be evaluated for possible addition to the monitoring network.

- **Brent Cullinan, Aloha Water Company Well No. 3-3104-03:** This well was approved for a PIP in 2010 for the purpose of providing potable ground water to a 9-acre property. The proposed uses for the water include agriculture, irrigation, and domestic use to support the production of livestock and various crops. This well is new since the previous Five-Year Review and is recommended to be evaluated for possible addition to the monitoring network.

An evaluation process should be performed by an environmental professional to determine applicability of these wells for inclusion in the monitoring network. The evaluation process is outlined in Section 7.1.

6.1.2.4 Assessment of the Vapor Intrusion Pathway

As part of the five year review a current assessment has been conducted to verify if the OU 2 vapor intrusion pathway remains insignificant. Based the previous risk assessment at the site for the OU 2 Remedial Investigation (RI)(Harding Lawson Associates [HLA], 1996b), the vapor exposure pathway from contaminated groundwater was deemed “insignificant” based on the depth to groundwater (approximately 500 to 600 feet) and the “relatively low concentrations of organics in the groundwater”. The contaminants were identified as trichloroethene (TCE) and carbon tetrachloride (CCl4). The primary sources of contamination could not be identified during the RI, and the groundwater was considered as the secondary source of contamination. Based on groundwater data to date, Supply Well 4 and MW-2-1 were found to have the highest concentrations of TCE in groundwater. The TCE concentrations in groundwater, however, have never been historically above 70 µg/L for any of the monitoring wells, and are considerably less in all the other monitoring wells. The concentrations of CCl4 in groundwater have been found stable and lower than 5 µg/L since 2000. The current U.S. Environmental Protection Agency (U.S. EPA) maximum contaminant level (MCL) for CCl4 is 5 µg/L (U.S. EPA, 1998).

The HDOH released the document Screening for Environmental Hazards at Sites with Contaminated Soil and Groundwater (Summer 2008) as a technical guidance for Environmental Hazard Evaluation (EHE). It was updated in 2011 and incorporates the U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs, June 2011).

In this five year review, the groundwater TCE vapor intrusion hazard was assessed with the current HDOH guideline (HDOH, 2011). The HDOH Tier 1 groundwater Environmental Action Level (EAL) for TCE for vapor emissions to indoor air is 610 µg/L in the new guideline. Using the most conservative value for TCE (70 µg/L - close but never exceeded) remains much lower than the HDOH EAL. Consequently, the groundwater TCE vapor intrusion pathway can be assumed to still not pose a significant threat to human health and the environment at this time even if there is new construction over the OU2 groundwater plume area(s). The details of the EHE output sheets from the HDOH web site (http://hawaii.gov/health/environmental/hazard/index.html) for the 70 µg/L TCE is presented in Appendix K.

6.2 Operable Unit 2 Remedy Inspections

Inspections of the OU 2 on-post groundwater monitoring wells, the Schofield Barracks WTP, the Kunia Village air stripper, and the SIC air stripper were conducted in March 2012. These inspections are described in this subsection, and an inspection checklist for the onpost monitoring wells is presented in Appendix F.

6.2.1 Onpost Groundwater Monitoring Wells

Onpost inspections of the Schofield Barracks groundwater monitoring wells were conducted during March of 2012. Items that were inspected included visible wiring of pump motors, surface well casings, concrete pads, protective housings around the surface casings, and bollards. AMEC noted several maintenance and access conditions that are summarized here and presented in the inspection checklist in Appendix F. The findings of the inspections included:

- Monitoring well MW 2-1 had sustained damage to the northwest and southwest bollards at the time of AMEC's site inspection. The bollards were no longer perpendicular to the ground and concrete surrounding the bollards has been severely cracked (Photo 32). AMEC also noted that there is no vent cap in place for this well (Photo 34).

- Monitoring well MW 2-2 is inside a locked construction area. AMEC contacted Carrie Nelson of DPW to arrange access to the area. Ms. Nelson contacted multiple construction management professionals within USACE in an attempt to determine the project manager for the site. Persons responsible for oversight of the construction area either were not available or did not respond to any of the inquiries and the well was not inspected (Photo 35).

- For monitoring well MW 2-5 AMEC noted that the hook on the exterior casing that secures the lid to the casing is bent and no longer functional (Photo 43). At the time of inspection the well was secured by padlock but the bent hook allowed the well to be opened from the opposite side. Also at the time of inspection, the road to access MW 2-5 was blocked by a downed tree (Photo 44). Range Control arranged to have the obstruction removed on 31 March 2012.

- For monitoring well MW 2-6 AMEC noted that the hook on the exterior casing that secures the lid to the casing had been bent at an approximately 30° angle (Photo 47). The hook is still functional, however, and the well was properly secured and locked at the time of AMEC's inspection.

- Monitoring well MW 4-1 is missing the interior well casing cap (Photo 49).

- The northwest bollard for MW 4-3 appears to be bent (Photo 52). Also, the padlock for this well could not be opened with the provided combination. The side of the lid opposite the padlock was not secured, however, and AMEC was able to access the interior of the well without opening the padlock. Upon inspection AMEC noted that the loop affixed to the lid of the monitoring well casing was bent at an approximately 45° angle and no longer functioned as intended (Photo 54).

- The padlock for MW 4-4 was not functioning at the time of site inspection and could not be opened with the provided combination (Photo 56). AMEC was unable to access the interior of the wellhead.

The remaining wells were found to be in good condition, properly secured and locked, with only minor corrosion noted on the padlocks and interior.

It should be noted that routine operation and maintenance (O&M) issues such as those documented above are consistently addressed under an O&M plan as they arise, and there are always a number of these issues in larger monitoring network like the one for OU2. AMEC has confirmed that there are procedures in place under the O&M plan. Consequently, they are not considered to compromise the either the current or future protectiveness of the remedy.

6.2.2 Schofield Barracks Water Treatment Plant

A site visit to the Schofield Barracks WTP was made on 23 March 2012. The system description for the Schofield Barracks WTP is found in Appendix A. Samples are reportedly collected from the influent and effluent by both the HDOH and the Army, and TCE concentrations must consistently be below the analytical detection limit of 0.5 µg/L. During the site visit, AMEC personnel noted pervasive corrosion in the brackets at the bottom of all five stripping towers (Photos 8 and 9). AMEC recommends that the structural integrity of the support brackets stripping towers with respect to the current condition of the support brackets be evaluated by knowledgeable party, and if deemed necessary be replaced. Although this visit was not a detailed inspection, the treatment plant was found to be operating and functioning as designed. A supplemental questionnaire was sent via email to Mr. Wayde Nakai, Water Treatment Plant Supervisor at the Schofield WTP, on 30 April 2012 as a follow-up to the site visit conducted on 23 March 2012. The purpose of the questionnaire was to provide additional information regarding the Schofield WTP operational history since the last 5 year review. Table F.3 in Appendix F is a summary of the questions and responses.

6.2.3 Kunia Village Air Stripper Treatment System

A site visit to the Kunia Village WTP at Kunia village was made on 23 March 2012. Samples are reportedly collected from the influent and effluent by the HDOH, and analytical results indicate TCE and CCl_4 concentrations have consistently been below the analytical detection limit of 0.5 µg/L. During the site visit, AMEC personnel noted corrosion in stem conjunction to hand-wheel of the main water valve, and minor leaking of the air blower gasket. According to the operator, Shane Lee, the air blower motor will need to be replaced in the next 2-3 years (Photo 2). The air blower gasket and rubber manifold are scheduled to be replaced the week of 26 March 2012 as part of routine maintenance (Photo 3). AMEC recommends removing the rust, and to repaint or replace the rusting part if needed as a general suggestion for minor metal corrosion. Although this visit was not a detailed inspection, the treatment plant was found to be operating and functioning as designed.

6.2.4 Sandwich Isles Communications Air Stripping System

SIC intends to use the 162-acre site at Waipio Acres for agricultural purpose. A water source for the property is available; however, the BWS currently limits the water use to domestic only. SIC has acquired a pump installation permit from the State of Hawaii DLNR to install a permanent deep well pump. In 2005, an exploratory well (SIC-01) was constructed to serve as a primary source of irrigation water for the site. The groundwater was sampled and was found to be contaminated with TCE at a level of 66 µg/L based on the Results of Drilling and Testing Report for the SIC-01 Exploratory Well by Water Resources Associated dated September 2005.

Citing the Final Record of Decision (ROD) for OU 2, SIC requested assistance from the US Army Garrison, Hawaii (USAG-HI) in treating the groundwater. The Army agreed to implement the contingency of wellhead treatment on any water supply wells that are impacted by the plume from Schofield Barracks above one-half of the MCL of 5 µg/L.

The SIC ASTS was designed and installed by Greenwave Solutions, Inc. (GreenWave) to remove TCE to below one-half of the MCL for TCE in drinking water (2.5 µg/L). The system includes two (2) air stripping towers along with its associated air blowers; a generator building housing a back-up generator, electrical panels, and chorine disinfection unit; a Granular Activated Carbon (GAC) air scrubber; a deep well pump; a transfer pump with wet well; and a water storage tank. The system description for the SIC ASTS is included in Appendix A. . Currently the well is being sampled quarterly as part of its initial start-up procedures.

A site visit to the SIC ASTS at Waipio Acres was made on 29 March 20127. The system Operations and Maintenance (O&M) is currently performed by Community Planning & Engineering, Inc. (CP&E). According to Puna Kaneakua of CP&E, the system will automatically start to operate when the water level in the storage tanks drops lower than the designed threshold. The system has operated about 18 hours accumulatively since the operation began on 17 February 2012. Quarterly sampling for the system is set to begin in 2012 and will be conducted by Environet, Inc. The site was secured with applicable signage (Photo 12). During the site visit, AMEC personnel noted two maintenance conditions: the tubing of some pressure gauges on one of the air stripping towers was not installed properly (Photo 14); and rust on the water storage tank valve (Photo 16). According to Mr. Kaneakua these conditions are scheduled to be resolved within two weeks following AMEC’s site visit. Although this visit was not a detailed inspection, the treatment plant was found to be operating and functioning as designed.

6.3 Operable Unit 4 Document and Data Review and Findings

Two historical documents relevant to the Schofield Barracks CERCLA process and other documents produced and data collected for OU 4 over the past five years were reviewed as a part of this five-year review process. This information included the OU 4 ROD, Second Five-Year Review Report (ECC and MACTEC, 2007a), quarterly landfill inspections reports, and landfill gas monitoring reports. A list of these documents is included in Appendix B, and discussions of the review and findings are presented in the following subsections.

6.3.1 Operable Unit 4 Historical Document Review

The only historical documents reviewed for OU 4 were the OU 4 ROD (HLA, 1996c) and the Second Five-Year Review Report. The OU 4 ROD presented a response action for OU 4, summarizes the rationale for remedy selection, identifies ARARs, and documents other aspects of the decision. The document was reviewed to ensure that the remedy remains in compliance with the ROD and to assess any revisions to the ARARs presented in the ROD over the past five years. Only one change to the ARARs was found that differs from the ARARs review discussion in the Second Five Year Review. That change is noted in *italic* text below. The ARARs presented in the OU 4 ROD (Tables 2.3 and 2.4) are presented in Appendix C and any changes to the regulations comprising the ARARs have been noted.

A summary of ARARs changes is as follows:

- Action-Specific ARARs
  - Several ARAR citations have been corrected from HAR to HRS.
  - Requirements under Long-term Groundwater Monitoring and Maintenance of the Landfill Cover have been revised to state that a period less than the postclosure care period is sufficient to show protectiveness of human health and the environment if this demonstration is approved by the director HAR S11-58.1-17(b)(2)(a).
- Location-Specific ARARs
  - Several ARAR citations have been corrected from HC to HRS.
  - *50 CFR 227, which relates to threatened or endangered habitat, was deleted from the CFR as of October 1, 1999.*

The ARARs are presented below:

- Action-specific ARARs:
  - Fugitive dust emission limitations contained in HAR 11-60.1-33 (a)(1-7)(b).
  - HAR 11-55-34.02 (b)(2), Appendix C, and HAR 11-55-34.04(b), Appendix A, requiring substantive compliance with storm-water discharge parameters (including monitoring storm-water discharge) associated with construction activity. An active NPDES permit is not required as it is an administrative requirement and not an ARAR.
  - HAR 11-58.1-16, requirements for groundwater monitoring during the postclosure care period at the Municipal Solid Waste Landfill (MSWLF) units.

- HAR 11-58.1-17(a)(9)(A, B), which requires a notation be placed on the landfill property following closure of the MSWLF to indicate the land was used as a landfill. The property deed will be modified if ownership of the affected parcel is transferred.

- HRS Title 28, Chapter 508C – Uniform Environmental Covenants Act, which allows an environmental covenant describing any activity or use limitations on the property to be added to the deed (if necessary) if the property is transferred.

- HAR 11-58.1-17(b) requiring postclosure care of the landfill for 30 years.

- HAR 11-59-4(f) and (h) limiting the concentration of ozone in ambient air to 100 micrograms per cubic meter ($\mu g/m^3$) in one hour.

- HAR 11-60.1-68 requiring monitoring and measurement of VOC emissions if emissions are greater than 1 ton per year for each air pollutant.

• Chemical-specific ARARs

  - None.

• Location-specific ARARs

  - None.

6.3.2 Recent Document Review and Findings

OU 4 documents reviewed for the past five years include quarterly landfill gas monitoring reports and landfill inspection reports. The following subsections present discussions of the review of these reports and the resulting findings.

6.3.2.1 Quarterly Landfill Gas Monitoring Reports

Quarterly landfill gas monitoring was conducted in accordance with the selected remedy described in the OU 4 ROD until terminated after the August 2007 sampling event upon approval by EPA and HDOH (HDOH, 2007b). Landfill gas monitoring was performed at the former Landfill in February, May, and August, 2007 to assess whether methane concentrations at the perimeter of the landfill exceeded the LEL. Concentrations exceeding the LEL would be in violation of the HAR 11-58-1.17**,** identified as an ARAR for OU 4 (Appendix C). Three quarterly landfill gas monitoring reports were prepared in 2007. Time versus concentration plots of methane concentration, oxygen concentration, and carbon dioxide concentration data collected as part of the long-term landfill gas monitoring program are presented in Appendix G.

Methane concentrations and the percent of the LEL for the three sampling events were zero. In the data from the three monitoring events, the data did not exceed or approach the LEL. Barometric pressure readings in the probes were usually equal to the atmospheric pressure readings. Therefore, methane concentrations in the atmosphere did not exceed the LEL.

Based on the three landfill gas sampling events in 2007 as well as the previous ten years of landfill gas monitoring data presented in the First and Second Five-year Reviews (Harding ESE, 2002, MACTEC, 2007), it was apparent that methane gas concentrations at the landfill perimeter were not an issue. The landfill is now old enough (over 30 years since last waste placement) that the methane gas production rate has decreased to a low enough level that it was no longer detectable in landfill gas monitoring events. Therefore, continued landfill gas monitoring was considered unnecessary and was eliminated with no loss in protectiveness.

6.3.2.2 Quarterly Landfill Inspection Reports

Other information that is relevant for the five-year review is contained in the quarterly landfill inspection reports, because they document performance of the OU 4 remedy on a regular basis. Landfill inspection reports from December 2006 to August 2011 were reviewed for this report (see Appendix H). As summarized in Table 6.5, the most serious problem observed in the performance of the remedy over the past five years was significant erosion in some drainage channels and cracking of the landfill cover due to settlement and desiccation. Heavy rains in December 2008 resulted in severe erosion of the east slope along the central drainage channel. Repairs to the erosion damage and identified cracks in the grouted riprap of that drainage channel were made in Summer 2010. Other problems with erosion including damage under the fence and around fence posts reported in 2007 were repaired during 2008.

A secondary issue related to performance of the OU 4 remedy has been the maintenance of the vegetative cover. The vegetation is maintained when necessary on an ongoing basis as part of the landfill operations and maintenance program. Extensive growth of Guinea grass and other invasive plants, though widespread, is controlled through a program of cutting and maintenance. In addition, barren areas were noted in several areas throughout the landfill. Some barren areas resulted from a fire in the early summer of 2007 and some areas were caused by stress on the vegetation. Through re-seeding and other efforts to reduce this stress, increased vegetative cover is now seen on formerly barren areas since 2007. There has been a marked improvement in the condition of the landfill since 2009 with no major deficiencies identified in 2010 or 2011.

6.3.3 Operable Unit 4 Remedy Inspection

The OU 4 remedy inspection was conducted at the Former Landfill on 23 March 2012. The purpose of the onpost inspection was to assess the effectiveness and protectiveness of the remedy. The inspection included an assessment of the security fence, signs, institutional controls, access roads, general site conditions, landfill surface, vegetative surface, drainage system, and landfill cover penetrations (landfill gas wells [no longer used], groundwater monitoring wells, etc.). An inspection checklist was filled out during the onpost inspection to assist in proper and complete documentation (see Appendix F).

Currently, the most significant maintenance issues noted during the inspection are the following:

- A deteriorated erosion control mat was observed at the north end drainage channel.

- A small barren area was observed near the north end drainage channel.
- A barren area was observed near the site access gate
- The road on the northeastern perimeter of the landfill that provides access to MW 4-4 and the bottom of the central drainage channel is showing signs of erosion and disrepair (Photo 26).

AMEC conducted interviews with Mr. Troy Rosenbush of ECC and Ms. Carrie Nelson of the Directorate of Public Works (DPW) on 23 March 2012. During the interviews, both Mr. Rosenbush and Ms. Nelson noted that large equipment consisting of a hydro-mulcher belonging to ECC had been stolen from the landfill site over the President's Day weekend of 2012. They stated that no evidence of break-in was noted, which led them to believe the individual responsible for the theft had the combination to the gate. In light of this event it is recommended that a record be kept of all site access, documenting the date, time, and persons present at the site. AMEC also recommends that the combination to the gate be changed periodically in an effort to prevent future breaches of security.

Mr. Rosenbush and Ms. Nelson also noted that during the summer months, cracking on the landfill surface is of greater concern than at the time of the site inspection. They mentioned that the limited water resources at the site make it difficult to prevent surface cracking and brown vegetation during periods of little to no rainfall. AMEC recommends that the current water delivery system on the site be evaluated and improvements made if reasonably feasible.

Also of note is the washout event that occurred in the central drainage channel in December 2008. Mr. Rosenbush and Ms. Nelson informed AMEC that a 100+ year rain event exceeded the capacity of the previous channel system and, as a result, rainwater overflowed the top of the drainage inlet structure and down the steep northern slope of the landfill. The overland flow rate of the water caused erosion along a small section of the northern slope and washed out the subsurface drainage features that conveyed water to the Kaukonahua Stream. ECC performed repairs to the drainage channel to accommodate a 100-year storm event. These repairs were conducted from June 2009 to November 2010. A Letter Report – Central Drainage Channel Repair detailing the scope of the repairs performed to the channel is presented in Appendix A. The landfill inspection reports are presented in Appendix H, and photographs illustrating the conditions noted above are presented in Appendix I.

The following are additional observations made during the five-year review site inspection:

- Access and institutional controls are currently in good condition.
- Roads are adequate with the exception of the road running along the northeastern perimeter of the landfill.
- There is no evidence of slope instability.
- Monitoring wells are properly secured, functioning, and routinely sampled.

6.4 Community Relations for Operable Unit 2 and Operable Unit 4

Community relations for OUs 2 and 4 over the past five years consisted of solicitations of interest in forming Restoration Advisory Boards (RABs) for Schofield Barracks, Kunia Field Station, Tripler Army Medical Center, and Fort Shafter were published in local Oahu newspapers in August 2008, April 2010, and July 2011. However, the solicitations collectively yielded less than five public responses of interest. Therefore, no RABs were formed. The solicitations are included in Appendix J.

Public notice of the Schofield Barracks five-year review is being conducted through both a posted fact sheet and a community mailing, in accordance with the Schofield Barracks Community Relations Plan (HLA, 1997). In compliance with Appendix A of the Comprehensive Five-Year Review Guidance (EPA, 2001) these public notice documents include:

- The site name and location
- The lead agency conducting the review
- A brief description of the selected remedy
- A summary of contamination addressed by the selected remedy
- A brief summary of the results of the five-year review
- The protectiveness statements
- A brief summary of data and information that provided the basis for determining protectiveness, issues, recommendations, and follow-up actions directly related to the protectiveness of the remedy
- How the community can contribute (public comment period)
- Locations where a copy of the five-year review report can be obtained or viewed
- A contact point and phone number for further information
- Dates of both the completion of the review and the next five-year review

In addition to the public notice documents, there was also a public comment period to allow involvement by members of the community.

The Five-year review public notice was published on May 13-15 2012; an affidavit of publication is included in Appendix J. Notification letters also went out to the established list of stakeholders. Interviews were conducted with stakeholders currently operating ASTS. Copies of the Draft Five year Review document were placed in the Mililani and Wahiawa libraries.

HDOH will be informed when the next round of solicitations in FY13 occur, and of any upcoming community relations events.

7.0 TECHNICAL ASSESSMENT

In accordance with the Comprehensive Five-Year Review Guidance, three questions are presented and answered for each OU in the following subsections to evaluate and assess the effectiveness and protectiveness of the remedy.

7.1 Operable Unit 2 Remedy Evaluation

This subsection presents answers to the three remedy and protectiveness evaluation questions for OU 2.

7.1.1 Evaluation of the Remedy for Operable Unit 2

Question A: Is the remedy functioning as intended by the decision documents?

Based on the information gathered during the five-year review process, the remedy is functioning as intended by the OU 2 ROD (HLA, 1996d) and OU 2 O&M Plan (HLA, 1996e). The Schofield Barracks Supply Wells and Kunia Village Wells 3-2803-05 and 3-2803-07 have operating wellhead treatment systems that incorporate air stripping to remove TCE and CCl_4 from groundwater and both systems are regularly maintained. The SIC ASTS was installed in 2011 and has recently been brought online to treat groundwater from Well 3-2801-03 for agricultural use. The long-term groundwater monitoring program is being implemented as described in the OU 2 ROD and OU 2 O&M Plan (HLA, 1996e). However, the groundwater remediation goals, which are MCLs for TCE and CCl_4, have not yet been achieved in subsurface groundwater. Because extracted groundwater does not meet MCLs, treatment, monitoring, and five-year reviews will continue until extracted groundwater does meet MCLs for TCE and CCl_4. Wellhead treatment is necessary as long as produced water is above MCLs, but the water within the aquifer does not need to achieve MCLs because of the TI waiver (EPA, 1996)(see Section 4.1.1).

Review of the data provided by DLNR concluded that four new wells had been installed in the monitoring area since the second five-year review: 3-2801-03, 3-3001-01, 3-3104-02, and 3-3104-03. An evaluation process should be performed by an environmental professional to determine applicability of these wells for inclusion in the monitoring network. The evaluation process should include the following information:

- **The proposed use of the well:** Water impacted by the TCE groundwater plume could potentially be harmful to public health if used as a potable source without treatment. The four wells added since the second five-year review are listed for agricultural and domestic water use purposes. These wells fall under the Safe Drinking Water Act and would require treatment if contaminants are found to be present above the applicable MCLs.

- **The location of the well relative to the known TCE plume:** Wells located outside the known plume area could be used to monitor for migration of the plume. Wells inside the plume area could be used to monitor the concentrations present and assess whether TCE or CCl_4 concentration is increasing or decreasing.

- **Water quality data available for the well:** If available, the results of water quality analyses performed on the well should be evaluated to determine whether TCE or CCl_4 are present. Presently, AMEC is only aware of relevant data for supply well 3-2801-03 located at the Sandwich Isle Communications Air Stripping System facility. Data for this well show a concentration of TCE in groundwater of 66 μg/L, exceeding the MCL of 5 μg/L.

- **Current construction of the well:** Information such as whether the well has a pump installed and the depth of the screening interval(s) should be collected to evaluate the applicability of the well for monitoring purposes.

Based on the results of this evaluation, the well should be assessed in the context of the current conceptual site model (CSM) and evaluated for any potential risk to receptors. A determination can then be made whether to include the well in the monitoring network, and at what frequency to monitor the well. If a well is added to the network, any changes to the monitoring frequency should be evaluated in accordance with “Assessment for Changes in Monitoring” in Figure 4.2

and decisions regarding treatment should be evaluated in accordance with “Evaluation for Potential Wellhead Treatment” in Figure 4.1.

Additional measures or ICs are needed to confirm new wells are not contaminated, and that there are adequate controls in place to prevent inadvertent exposure going forward. While reviewing all new well applications and pumping permits is part of the 5-YR Review process, the Army recommends that this review should happen on a more frequent basis, possibly once a year as part of the Annual Report for OU-2 & OU-4. Although the Hawaii Safe Drinking Water Act does require sampling for TCE and CCl_4 for all new drinking water wells, it will be proposed that the owners of the identified new wells be contacted and briefed, and the wells be sampled for COCs as necessary. Additionally, further coordination between HDOH, DLNR and USAG-HI DPW Environmental, needs to be established when a new well application is received within a specified geographic area where groundwater impacts exist, so those applicants can be notified, and their wells sampled as necessary. This approach has been outlined to HDOH and details are being formalized.

7.1.2 Evaluation of Previous Assumptions for Operable Unit 2

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

No changes to the exposure assumptions, cleanup levels or RAOs were found during the review process. It should be noted that U.S. EPA has recently updated TCE Toxicity in IRIS, but still considers the TCE MCL of 5 µg/L protective for both cancer and non-cancer effects.

Groundwater results are compared to U.S. EPA Regional Screening Levels (RSLs) as a first step in determining whether response actions may be needed to address potential human health exposures. The RSLs are chemical-specific concentrations that correspond to an excess cancer risk level of $1x10^{-6}$ (or a Hazard Quotient (HQ) of 1 for noncarcinogens) developed for standard exposure scenarios (e.g., residential and commercial/industrial). RSLs are not de facto cleanup standards for a Superfund site, but they do provide a good indication of whether actions may be needed. In September 2011, EPA completed a review of the TCE toxicity literature and posted on IRIS both cancer and non-cancer toxicity values which resulted in lower RSLs for TCE. The screening level for chronic exposure for cancer excess risk level of $1x10^{-6}$ is 0.44 µg/L. EPA uses an excess cancer risk range between 10^{-4} and 10^{-6} for assessing potential exposures, which means a TCE concentration between 0.44 and 44 µg/L. The current MCL for TCE of 5 µg/L which is within the revised protective carcinogenic risk range. EPA's 2011 Toxicological Review for TCE also developed safe levels that include at least a 10 fold margin of safety for health effects other than cancer. Any concentration below the non-cancer RSL indicates that no adverse health effect from exposure is expected. Concentrations significantly above the RSL may indicate an increased potential of non-cancer effects. The non-cancer screening level for TCE is 2.6 µg/L. EPA considers the TCE MCL of 5 µg/L protective for both cancer and non-cancer effects.

7.1.3 Evaluation of Effectiveness/Protectiveness of Operable Unit 2

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information was found during this five-year review that would raise doubt about the protectiveness of the OU 2 remedy. An evaluation of new water supply wells should be conducted to assess whether human health or the environment may be potentially be exposed to TCE or CCl_4 concentrations above the MCLs, and action consistent with the remedy should be taken.

7.2 Operable Unit 4 Remedy Evaluation

This subsection presents answers to the three remedy and protectiveness evaluation questions for OU 4.

7.2.1 Evaluation of the Remedy for Operable Unit 4

Question A: Is the remedy functioning as intended by the decision documents?

Review of the ARARs, risk assumptions, quarterly data, landfill inspection reports, and the five-year review site inspection indicate that the OU 4 remedy will continue to improve groundwater conditions and function as intended provided that continued maintenance and repair are performed on the landfill cover. The operations and maintenance required to maintain the integrity and functionality of the landfill cover include continued routine inspections, periodic repair of the cracks, landscaping maintenance, regrading due to settlement, and revegetation of regraded areas. A major repair to the central drainage channel was conducted in 2010 to repair damage done by heavy rains in December 2008 and restore the channel to functionality. Landfill gas monitoring was discontinued in 2007 because of the very low or undetected methane concentrations measured during the years 2001 to 2006.

Cracks in the landfill cover have been noted periodically in inspection reports for the past five years (Table 6.5). However, the cracks are repaired as part of ongoing maintenance activities. The occurrence of cracks in the cover has also been reduced by the irrigation of the landfill cover. This process has also improved the condition of the landfill vegetative cover. At the landfill inspection for this five-year review, the landfill cracks appeared to be under control.

The average annual O&M cost over the last five years was approximately $554,000. This cost includes landfill gas monitoring (now discontinued), landfill landscaping, crack repair, and an extensive repair to the central drainage channel in 2010. Excluding the central drainage repair, the average O&M cost was approximately $280,000. It is likely that this amount, and possibly more, would be required on an annual basis to maintain the integrity and functionality of the existing remedy. Additional future costs may include repair and maintenance of the drainage system and maintenance of the side slopes.

The existing institutional controls include prohibitions on the use or disturbance of groundwater, prohibitions on excavation activities, disturbance of the landfill cover, and any other activities that might interfere with the implemented remedy. No vandalism of the fencing was observed that would have violated these institutional controls; however, the theft of some large machinery indicates that site security measures must be enhanced. The fence around the site is intact and in good condition, with the exception of erosion near some fence posts that needs to be restored.

The objective when implementing land use controls is to develop a system of mutually reinforcing controls to ensure that land use is consistent with restrictions placed on the property during the environmental restoration process (DoD, 2001a). The institutional controls specified in the OU 4 ROD (HLA, 1996c) are groundwater monitoring, five-year site review, land use restrictions, and site security. The OU 4 O&M Plan (HLA, 1996f) documents procedures for implementing those controls through long-term groundwater and landfill gas monitoring and physical inspections of the landfill and the security fence. As mandated in DoD policy (DoD, 2001a) and guidance (DoD, 2001b), landfill land use controls are stored in a land use control layer in the installation GIS database.

The four OU 4 monitoring wells MW-4-1 to MW-4-4 are registered with DLNR Commission on Water Resource Management for environmental monitoring use. As described in Section 4.1.2, a change in well use would require a request to the Commission on Water Resource Management to do so. Any new wells installed in the vicinity of the landfill would also require permits, and because of the institutional controls in the base environmental records, a request for the use of groundwater for water supply would not be approved without provisions for water treatment.

If the landfill property were being considered for transfer to another party, a Finding of Suitability for Transfer (FOST) would need to be prepared (DoD, 2001a). The FOST would need to include discussion of the institutional controls for the landfill. However, no such transfer is being considered. At the time DoD property is transferred from federal ownership, DoD or the transferee will execute a restrictive covenant regarding land use controls then in effect for environmental restoration sites in a form acceptable to DOH and consistent with DoD policy (DoD, 2001a).

7.2.2 Evaluation of Previous Assumptions for Operable Unit 4

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy implementation are still valid.

Changes in Standards and To Be Considered

During construction and since completion of the remedial action, the action-specific ARARs cited in the OU 4 ROD (HLA, 1996c) have been met. However, some of the ARARs included in the ROD do not apply to current activity at the Former Landfill. These ARARs include substantive compliance with NPDES requirements, fugitive dust emission limitations, placement of a notation on the landfill property indicating it was used as a landfill, and monitoring and measurement of VOC emissions if emissions are greater than 1 ton per year for each pollutant. Additional construction activity or changes in site conditions may have an effect on the applicability of the ARARs (i.e., additional construction activity would require substantive compliance with storm-water discharge parameters and compliance to fugitive dust emission limitations); however, all of the ARARs are currently being met. Minor changes in ARARs and To Be Considered (TBCs) have occurred, as presented Appendix C. None of these changes affect the protectiveness of the remedy.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

Since implementation of the remedy, there have been no changes in land use, no new contaminants or contaminant sources, no changes in toxicity and other contaminant characteristics, no remedy byproducts, and no changes in exposure pathways. Therefore, the risk assessment should not be any different than when the remedy was first implemented. The media of interest for the OU 4 baseline risk assessment (see Appendix I of the FS) were surface soil, surface water, and sediment. Exposure to these media has not been affected by minor cracks or sporadic lack of vegetation on the landfill cover.

7.2.3 Evaluation of Effectiveness/Protectiveness of Operable Unit 4

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

According to the landfill site inspection reports and the landfill gas monitoring data, the remedy is functioning as intended by the OU 4 ROD with continued maintenance and repair. The OU 4 ARARs cited in the OU 4 ROD have been met. There have been no changes in land use, no new contaminants or contaminant sources, no changes in toxicity and other contaminant characteristics, no remedy byproducts, and no changes in exposure pathways.

No ecological targets were identified in the baseline risk assessment and none were identified during the five-year review. Therefore, monitoring of ecological targets is not necessary. One heavy rainfall event caused damage to the central drainage channel and cover, but these damages were repaired and thus have not affected the protectiveness of the remedy.

Based on these unchanged conditions, the risk assessment does not require reevaluation. There is no other information or reason to question the protectiveness of the remedy.

7.3 Summary of Technical Assessment

Based on the review of documents, reports, and data for OU 2 and OU 4 for the past five years, the remedies are functioning as intended by their respective RODs. A new supply well (SIC well 3-2801-03) has been installed, but an air stripper has also been installed to treat TCE-contaminated groundwater for agricultural use. Additional coordination between USAG-HI, DLNR, and HDOH should be implemented to assure that no domestic wells are installed and put into use that may allow human exposure to TCE-contaminated water. Continued maintenance and repair of the landfill cover is required to maintain the protectiveness of the OU 4 remedy. In addition, there were no changes in RAOs, and the risk assessments do not require any reevaluation. There is no additional information available that would provide a reason to question the protectiveness of the remedies.

8.0 ISSUES REGARDING REMEDIAL MEASURES

Issues or items that need to be addressed or resolved to maintain the effectiveness and protectiveness of the remedies are discussed in this section. Issues for OU 2 and OU 4 are presented separately below and are summarized in Table 8.1.

8.1 Issues Regarding Operable Unit 2

Issues regarding the continued effectiveness and protectiveness of the OU 2 remedy are the following:

- A new supply well (SIC well 3-2801-03) has been installed, and an air stripper has also been installed to treat TCE-contaminated groundwater for agricultural use. This well should be added to the monitoring network once the quarterly sampling associated with the ASTS start-up program has been completed.

- Three other new wells (3-3001-01, 3-3104-02, and 3-3104-03) have been installed in the monitoring network area. These wells should be evaluated to see if they are appropriate for addition to the monitoring network.

- Additional coordination between USAG-HI, DLNR, and HDOH should be implemented to assure that no domestic wells are installed and put into use that may allow human exposure to TCE-contaminated water.

8.2 Issues Regarding Operable Unit 4

No issues regarding the continued effectiveness and protectiveness of the OU 4 remedy were identified. Items such as landfill cover cracking and local erosion problems are addressed through an ongoing maintenance program.

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Issues have been identified for each OU during this five-year review that must be addressed for the respective remedies to continue to be protective of human health and the environment. In addition, the analytical data for each well have been evaluated to assess whether changes in monitoring frequency are warranted. This section presents recommendations and follow-up actions for addressing the remedy issues and the recommendations for changes in monitoring frequency.

9.1 Recommendations and Follow-up Actions for Operable Unit 2

Issues regarding the effectiveness and protectiveness of the OU 2 remedy, as implemented, are identified in Section 8.1. Measures to address these issues include the following:

- Add new supply well (SIC well 3-2801-03) to the monitoring network. This well has an air stripper that has also been installed to treat TCE-contaminated groundwater for agricultural use.
- Evaluate three other new wells (3-3001-01, 3-3104-02, and 3-3104-03) installed in the monitoring network area to see if they are appropriate for addition to the monitoring network.
- Additional coordination between USAG-HI, DLNR, and HDOH should be implemented to assure that no domestic wells are installed and put into use that may allow human exposure to TCE-contaminated water.

9.1.1 Evaluation of New Wells for Addition to Monitoring Network

Review of the data provided by DLNR concluded that four new wells had been installed in the monitoring area since the second five-year review: 3-2801-03, 3-3001-01, 3-3104-02, and 3-3104-03. The first of these four wells is recommended for addition to the monitoring network, but an evaluation process should be performed by an environmental professional to determine applicability of the other three wells for inclusion in the monitoring network. The evaluation process should include the following information:

- The proposed use of the well
- The location of the well relative to the known TCE plume
- Water quality data available for the well
- Current construction of the well

Based on the results of this evaluation, the well should be assessed in the context of the current conceptual site model (CSM) and evaluated for any potential risk to receptors. A determination can then be made whether to include the well in the monitoring network, and at what frequency to monitor the well.

9.1.2 Evaluation of New Wells in the Future

Additional measures or ICs are needed to confirm new wells are not contaminated, and that there are adequate controls in place to prevent inadvertent exposure going forward. While reviewing all new well applications and pumping permits is part of the 5-YR Review process, the Army recommends that this review should happen on a more frequent basis, possibly once a year as part of the Annual Report for OU-2 & OU-4. Although the Hawaii Safe Drinking Water Act does require sampling for TCE and CCl_4 for all new drinking water wells, it will be proposed that the owners of the identified new wells be contacted and briefed, and the wells be sampled for COCs as necessary. Additionally, further coordination between HDOH, DLNR and USAG-HI DPW Environmental, needs to be established when a new well application is received within a specified geographic area where groundwater impacts exist, so those applicants can be notified, and their wells sampled as necessary. This approach has been outlined to HDOH and details are being formalized.

Recommendations and follow-up actions presented in Section 9.1 are summarized in Table 9.3.

9.2 Recommendations and Follow-up Actions for Operable Unit 4

No issues regarding the effectiveness and protectiveness of the OU 4 remedy, as implemented, are identified in Section 8.2. Routine maintenance and repair of remedy components must be continued in order to achieve maximum performance of the OU 4 remedy.

Recommendations and follow-up actions presented in Section 9.2 are summarized in Table 9.3.

10.0 PROTECTIVENESS STATEMENTS

Based on the findings of the third five-year review, the remedies for OU 2 and OU 4 have been evaluated and recommendations and follow-up actions have been identified. Based on the implementation of these measures, protectiveness statements are made below for each OU.

10.1 Effectiveness of Current Measures for Operable Unit 2

The primary RAO for the OU 2 implemented remedy was to protect human health and the environment by limiting contact with groundwater exceeding the MCLs. Human health is protected by using air strippers to treat groundwater from supply wells with concentrations above the MCLs (the four Schofield Barracks Supply Wells, Kunia Village Wells 3-2803-05 and 3-2803-07, and new SIC well 3-2801-03). The treatment systems are fully operational and functional and treat groundwater to remove contaminants to levels an order of magnitude below MCLs. New wells installed since 2007 should be evaluated for possible addition to the monitoring network. Measures to better track the installation of new wells and the need for verifying water quality in new wells are being discussed with HDOH and DLNR. Results from the monitoring well network show that the plume is not migrating downgradient. The Army will continue to maintain and operate the treatment systems and the monitoring well network until TCE and CCl_4 MCLs are achieved in groundwater, and will respond to any unforeseen increases in TCE levels downgradient of Schofield Barracks. Therefore, the remedy continues to be effective and protective.

10.2 Effectiveness of Current Measures for Operable Unit 4

The primary RAO of the implemented remedy was to protect human health and the environment by limiting direct contact with the Former Landfill contents and by restricting surface-water infiltration through the landfill. Construction and implementation of the landfill cover met the first half of the RAO by limiting direct contact with the Former Landfill contents. Continued repair and maintenance of the OU 4 remedy will continue to comply with the second half of the RAO by restricting surface-water infiltration through the landfill. Therefore, the remedy continues to be effective and protective.

11.0 NEXT REVIEW

The next review for Schofield Barracks OU 2 Groundwater and OU 4 Former Landfill is scheduled to begin in five years, by March 2017, and be finalized by 24 September 2017.

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Table 4.1: Long-Term Groundwater Monitoring Well Network
Third Five-Year Review Period
Schofield Army Barracks

Site Identification	Well Name	Operable Unit and Well Type
26003GWPK	3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply
26031GWPW	3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply
27025GWPW	3-2702-05	OU 2 Offsite Monitoring Well
270302GW/DELMONTENU	3-2703-02 (Del Monte)	OU 2 Offsite Irrigation Well
28003GWPK	3-2800-03	OU 2 Offsite Domestic/Municipal Water Supply
OU2-4GWSH	3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well
OU2-6GWSH	3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well
28031GWSH*	3-2803-01 (3-2803-03)*	OU 2 Offsite Industrial Well
28035GWSH	3-2803-05 (Del Monte)	OU 2 Offsite Irrigation/Municipal Water-Supply Well
28037GWSH	3-2803-07 (Del Monte)	OU 2 Offsite Irrigation/Municipal Water-Supply Well
28591GWPK	3-2859-01	OU 2 Offsite Domestic/Municipal Water Supply Well
OU2-1GWSH	3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well
SCHMWGWSH	3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well
SCH1GWSH	3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well
SCH2GWSH	3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well
SCH3GWSH	3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well
SCH4GWSH	3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well
290111GWSH	3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply
290112GWSH	3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply
OU1-1GWSH	3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well
29021GWSH	3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply
OU2-3GWSH	3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well
OU2-2GWSH	3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well
OU2-5GWSH	3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well
OU4-1GWSH	3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well
OU4-3GWSH	3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well
OU4-4GWSH	3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well
OU4-2AGWSH	3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well
31002GWSH	3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply
31022GWSH	3-3102-02	OU 2 Offsite Irrigation Well
31031GW	3-3103-01	OU 4 Offsite Irrigation Well
32032GWSH	3-3203-02	OU 2 Offsite Irrigation Well

OU - Operable Unit
* Hawaii Department of Land and Natural Resources records list 3-2803-03 as the well that is being sampled.

Table 4.2: Operation and Maintenance Cost for Operable Unit 2
Fiscal Years 2007 through 2011
Third Five-Year Review Period
Schofield Army Barracks

ACTIVITY	2007	2008	2009	2010	2011	TOTAL
Long-term Groundwater Monitoring and Reporting[1]	$113,027	$81,633	$97,716	$105,768	$90,510	$488,654
Schofield Barracks WTP Air Stripper O&M&M*	NP	NP	NP	NP	NP	
Del Monte Air Stripper Treatment System O&M	$28,000	$35,000	$47,000	$48,000	$46,000	$204,000
TOTAL	$141,027	$116,633	$144,716	$153,768	$136,510	$692,654

* - Includes routine operation and maintenance and quarterly operations monitoring
1 - The cost of the Five Year Review in 2007 was apportioned between OU2 and OU4.
O&M&M - Operation and Maintenance and Monitoring
OU - Operable Unit
NP - Not Provided by the Army
WTP - Water Treatment Plant

Table 4.3: Well Monitoring Frequencies
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Proposed Monitoring Frequency in Second FYR	Current Monitoring Frequency	Proposed Monitoring Frequency in Third FYR
3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply	Stable; <1 µg/L	<1 µg/L; stable	Annual	Annual	Annual
3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable; <1 µg/L	<1 µg/L; stable	Annual	Annual	Annual
3-2702-05	OU 2 Offsite Monitoring Well	Increasing trend; <5 µg/L	<1 µg/L; stable	Annual	Annual	Annual
3-2703-02 (Del Monte Basal)	OU 2 Offsite Irrigation Well	Slight increasing trend since October 2008; <1 µg/L	<1 µg/L; stable	Annual	Annual	Annual
3-2800-03/3-2800-01*	OU 2 Offsite Domestic/Municipal Water Supply	Stable; <1 µg/L	<1 µg/L; stable	Annual	Annual	Annual
3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well	In the plume; increasing trend since August 2009	<1 µg/L; stable	Annual	Annual	Annual
3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well	In the plume; slight increasing trend; <5 µg/L	< 5 µg/L; slight increasing trend since November 2009	Annual	Annual	Annual
3-2803-01	OU 2 Offsite Industrial Well	In the plume; increase to 4 µg/L in 2010. Decreased to <1 µg/L in 2011.	CCl_4 concentrations increased above 1 µg/L in November 2005; <1 µg/L since then	Annual	**Semiannual**	**Semiannual**
3-2803-05 (Del Monte #3)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	In the plume; gradual increasing trend; >5 µg/L in 2011	CCl_4 concentrations increased above 1 µg/L in November 2005; <2.5 µg/L and gradual increasing trend since then	Quarterly	Quarterly	Quarterly

Table 4.3: Well Monitoring Frequencies
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Proposed Monitoring Frequency in Second FYR	Current Monitoring Frequency	Proposed Monitoring Frequency in Third FYR
3-2803-07 (Del Monte #4)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	In the plume; >2.5 µg/L, increasing trend since 2005.	<1 µg/L; stable	Annual	**Semiannual**	**Semiannual**
3-2859-01	OU 2 Offsite Domestic/Municipal Water Supply Well	<1 µg/L; stable; last sampled in August 2009	<1 µg/L; stable; last sampled in August 2009	Annual	Annual	Annual
3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well	In the plume; >10 µg/L, increasing trend since August 2009	<1 µg/L; stable	Annual	Annual	Annual
3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well	In the plume; stable; <1 µg/L, last sampled in August 2009	<1 µg/L; stable; last sampled in August 2009	Annual	Annual	Annual
3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L, stable	<1 µg/L; stable	Semiannual	Semiannual	Semiannual
3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L, stable	<1 µg/L; stable	Semiannual	Semiannual	Semiannual
3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L, stable	<1 µg/L; stable	Semiannual	Semiannual	Semiannual
3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L; increased to > 60 µg/L in August 2005 and May 2011; generally fluctuating between 35 and 55 µg/l	<1 µg/L; stable	Quarterly	Quarterly	Quarterly

Table 4.3: Well Monitoring Frequencies
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Proposed Monitoring Frequency in Second FYR	Current Monitoring Frequency	Proposed Monitoring Frequency in Third FYR
3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable; last sampled in August 2007	<1 µg/L; stable; last sampled in August 2007	Annual	Annual	Annual
3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable	<1 µg/L; stable	Annual	Annual	Annual
3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well	In the plume, generally <5 µg/L; exceeded 2.5 µg/L since Aug. 2009; exceeded 5 µg/L in Aug. 2010 and March 2011.	<1 µg/L; stable	Annual	Semiannual	Semiannual
3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 µg/L	<1 µg/L; stable	Annual	Annual	Annual
3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well	In the plume; >5 µg/l; slight decreasing trend	In the plume; stable; <2.5 µg/L	Annual	Annual	Annual
3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well	Downgradient of landfill; stable; <1 µg/L	<1 µg/L; stable	Annual	Annual	Annual
3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well	In the plume; <1 µg/L; very slight decreasing trend	<1 µg/L; stable	Annual	Annual	Annual
3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well	Landfill well; >10 µg/L; Decreasing trend; Consider increasing the sampling frequency back to semiannual if TCE >30 µg/L.	Landfill well; <5 µg/L; Gradual decreasing trend since 1995. Consider increasing the sampling frequency back to semiannual if CCl_4 >6 µg/L.	Annual	Annual	Annual

Table 4.3: Well Monitoring Frequencies
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Proposed Monitoring Frequency in Second FYR	Current Monitoring Frequency	Proposed Monitoring Frequency in Third FYR
3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well	Landfill well; >5 µg/L; Increasing trend through 2006, generally decreasing since then; increased in August 2011	Landfill well. >2.5 µg/L but <5 µg/L; stable	Semiannual	Semiannual	Semiannual
3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well	Landfill well; >5 µg/L; Increasing trend until 1998; concentrations between 20 and 30 µg/L since then	Landfill well; >2.5 µg/L but <5 µg/L; possible current increasing trend	Semiannual	Semiannual	Semiannual
3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well	Landfill well; Increasing from 2003 through 2006, but <2.5 µg/L; decreasing trend since then	<1 µg/L; stable	Annual	Annual	Annual
3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply	< 1 µg/L; stable	< 1 ug/L; stable	Annual	Annual	Annual
3-3102-02	OU 2 Offsite Irrigation Well	<1 µg/L; stable	<1 µg/L; stable	Annual	Annual	Annual
3-3103-01	OU 4 Offsite Irrigation Well	Downgradient of landfill; <1 µg/L; stable	<1 µg/L; stable	Annual	Annual	Annual
3-3203-02	OU 2 Offsite Irrigation Well	< 1 µg/L; stable	<1 µg/L; stable	Annual	Annual	Annual

Notes:
CCl_4 - Carbon Tetrachloride
TCE - Trichloroethene
µg/L - Micrograms per liter
OU - Operable Unit
TCE - Trichloroethene

* Well was sampled as a substitute for a comparable well that was out of service.
Bold text signifies a change in monitoring frequency from the Second Five Year Review.

Table 4.4: Operation and Maintenance Cost for Operable Unit 4
Third Five-Year Review Period
Schofield Army Barracks

ACTIVITY	2007	2008	2009	2010	2011	TOTAL
Landfill O&M	$405,000	$232,000	$205,000	$140,000	$400,000	$1,382,000
Landfill Drainage Repair	$0	$0	$0	$1,386,000	$0	$1,386,000
Landfill Inspection and Monitoring[1,2,3]	$59,425	$12,621	$13,053	$13,520	$13,993	$112,612
Totals	$464,425	$244,621	$218,053	$1,539,520	$413,993	$2,880,612

- The cost for reporting was included with the monitoring cost.

1 - Landfill inspection and monitoring includes the landfill inspection, groundwater monitoring and landfill gas monitoring.

2 - The Landfill Gas Monitoring Program was terminated after the August 2007 event.

3 - The cost of the Five Year Review in 2007 was apportioned between OU2 and OU4.

O&M - Operation and Maintenance

OU - Operable Unit

Table 6.1: Summary of NPL Groundwater Sampling Programs Conducted To Date
Third Five Year Review Period
Schofield Army Barracks Operable Units 2 and 4

Sampling Round	Sampling Dates	Associated Sampling Program
Round 42	February 2007	Semiannual sampling
Round 43	May 2007	Quarterly sampling
Round 44	June to September 2007	Annual sampling
Round 45	December 2007	Quarterly sampling
Round 46	February 2008	Semiannual sampling
Round 47	May 2008	Quarterly sampling
Round 48	August 2008	Annual sampling
Round 49	November 2008	Quarterly sampling
Round 50	February 2009	Semiannual sampling
Round 51	May 2009	Quarterly sampling
Round 52	July and August 2009	Annual sampling
Round 53	November and December 2009	Quarterly sampling
Round 54	February 2010	Semiannual sampling
Round 55	June 2010	Quarterly sampling
Round 56	July to September 2010	Annual sampling
Round 57	October 2010	Quarterly sampling
Round 58	March 2011	Semiannual sampling
Round 59	May 2011	Quarterly sampling
Round 60	July to September 2011	Annual sampling
Round 61	October 2011 to December 2011	Quarterly sampling

Table 6.2: Long-Term Groundwater Monitoring Wells Trend Evaluation
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Current Monitoring Frequency
3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable	<1 µg/L; stable	Annual
3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable	<1 µg/L; stable	Annual
3-2702-05	OU 2 Offsite Monitoring Well	<5 µg/L; increasing trend	<1 µg/L; stable	Annual
3-2703-02 (Del Monte Basal)	OU 2 Offsite Irrigation Well	<1 µg/L; slight increasing trend since October 2008	<1 µg/L; stable	Annual
3-2800-03/3-2800-01*	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable	<1 µg/L; stable	Annual
3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well	In the plume; >10 µg/L, increasing trend since August 2009; overall decreasing trend	<1 µg/L; stable	Annual
3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well	In the plume; <5 µg/L; slight increasing trend; overall decreasing	< 5 µg/L; slight increasing trend	Annual
3-2803-01	OU 2 Offsite Industrial Well	In the plume; increased to 4 µg/L in 2010; 3.6 µg/L in 2012	Increased above 1 µg/L in November 2005; <1 µg/L since then	Semiannual
3-2803-05 (Del Monte #3)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	In the plume; gradual increasing trend; >5 µg/L in 2011; <5 µg/L in 2012	Increased above 1 µg/L in November 2005; <2.5 µg/L; gradual increasing trend since then	Quarterly
3-2803-07 (Del Monte #4)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	In the plume; increasing trend since 2007; >2.5 µg/L since 2008 but <5 µg/L	<1 µg/L; stable	Semiannual
3-2859-01	OU 2 Offsite Domestic/Municipal Water Supply Well	<1 µg/L; stable; last sampled in August 2009	<1 µg/L; stable; last sampled in August 2009	Annual
3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well	In the plume; >10 µg/L, increasing trend since August 2009; overall decreasing trend	<1 µg/L; stable	Annual

Table 6.2: Long-Term Groundwater Monitoring Wells Trend Evaluation
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Current Monitoring Frequency
3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well	In the plume; stable; <1 µg/L, last sampled in August 2009; overall decreasing trend	<1 µg/L; stable; last sampled in August 2009	Annual
3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L; increasing trend since August 2010	<1 µg/L; stable	Semiannual
3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L, stable	<1 µg/L; stable	Semiannual
3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L, increasing trend since August 2010	<1 µg/L; stable	Semiannual
3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L; increased to > 60 µg/L in August 2005 and May 2011; generally fluctuating between 35 and 55 µg/l	<1 µg/L; stable	Quarterly
3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable; last sampled in August 2007	<1 µg/L; stable; last sampled in August 2007	Annual
3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable	<1 µg/L; stable	Annual
3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well	In the plume, generally <5 µg/L; >5 µg/L in Aug. 2010 and March 2011; <5 since then	<1 µg/L; stable	Semiannual
3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable	<1 µg/L; stable	Annual
3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well	In the plume; <5 µg/l since 2006; >5 µg/l in 2011; slight decreasing trend	In the plume; <2.5 µg/L; stable	Annual
3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well	Downgradient of landfill; <1 µg/L; stable	<1 µg/L; stable	Annual
3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well	In the plume; <1 µg/L; stable	<1 µg/L; stable	Annual

Table 6.2: Long-Term Groundwater Monitoring Wells Trend Evaluation
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Current Monitoring Frequency
3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well	Landfill well; >10 µg/L; decreasing trend	Landfill well; >2.5 µg/L but <5 µg/L; gradual decreasing trend since 1995	Annual
3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well	Landfill well; >10 µg/L; increasing trend through 2006; concentrations between 20 and 30 µg/L since then	Landfill well. >2.5 µg/L but <5 µg/L; stable	Semiannual
3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well	Landfill well; >10 µg/L; increasing trend until 1998; concentrations between 20 and 30 µg/L since then	Landfill well; >2.5 µg/L but <5 µg/L; slight increasing trend	Semiannual
3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well	Landfill well; increasing from 2003 through 2006, but <2.5 µg/L; decreasing trend since then	<1 µg/L; stable	Annual
3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply	< 1 µg/L; stable	< 1 ug/L; stable	Annual
3-3102-02	OU 2 Offsite Irrigation Well	<1 µg/L; stable	<1 µg/L; stable	Annual
3-3103-01	OU 4 Offsite Irrigation Well	Downgradient of landfill; <1 µg/L; stable	<1 µg/L; stable	Annual
3-3203-02	OU 2 Offsite Irrigation Well	< 1 µg/L; stable	<1 µg/L; stable	Annual

Notes:
CCl_4 - Carbon Tetrachloride
TCE - Trichloroethene
µg/L - Micrograms per liter

* Well was sampled as a substitute for a comparable well that was out of service.

Table 6.3: Network Wells Not Sampled
During Third Five-Year Review Period
Schofield Army Barracks

State Permit Well Number	Well Owner	Alternative Well Name/Number	Site	Current Monitoring Frequency	Round 42 (Semiannual) February 2007	Round 43 (Quarterly) May 2007	Round 44 (Annual) June-September 2007	Round 45 (Quarterly) December 2007	Round 46 (Semiannual) February 2008	Round 47 (Quarterly) May 2008	Round 48 (Annual) August 2008	Round 49 (Quarterly) November 2008	Round 50 (Semiannual) February 2009	Round 51 (Quarterly) May 2009	Round 52 (Annual) August 2009	Round 53 (Quarterly) November-December 2009
3-2600-03	BWS	Mililani III Well # 2 (BWS Unit #8)	OU2	A												
3-2603-01	HCC	Hawaii Country Club	OU2	A												
3-2702-05	USAF	Waikakalaua # 5	OU2	A			Pump out of service				No dedicated pump, sampled in Round 49.					
3-2703-02	Del Monte	"Basal Well" (fka New M.W.)	OU2	A							No dedicated pump, sampled in Round 49.					
3-2800-03/01	BWS	Mililani I Well # 3 (BWS Unit #3)	OU2	A												
3-2801-02	USA	MW-2-4	OU2	A												
3-2802-01	USA	MW-2-6	OU2	A											Pump out of service, sampled in Round 53	
3-2803-01	USA	Navy Kunia	OU2	S												
3-2803-05	Del Monte	Kunia Battery (Pump # 3)	OU2	Q												
3-2803-07	Del Monte	Kunia (Pump # 4)	OU2	S												
3-2859-01/02	BWS	Mililani II Well # 1 (BWS Unit #5)	OU2	A												
3-2900-02	USA	MW-2-1	OU2	A												
3-2901-01	USA	Schofield Shaft Monitoring Well	OU2	A												
3-2901-02	USA	Schofield Supply Well #1	OU2	S												
3-2901-03	USA	Schofield Supply Well #2	OU2	S			Pump out of service. Well 3-2901-02 sampled instead in Round 45.		Pump out of service							
3-2901-04	USA	Schofield Supply Well #3	OU2	S											Pump out of service	
3-2901-10	USA	Schofield Supply Well #4	OU2	Q		Pump out of service										
3-2901-11/08	BWS	Wahiawa I Well # 1 (BWS Unit #1)	OU2	A							Pump out of service				Pump out of service	
3-2901-12	BWS	Wahiawa I Well # 2	OU2	A												
3-2901-13	USA	MW-1-1	OU2	S												
3-2902-01	BWS	Wahiawa II Well # 1 (BWS Unit #1)	OU2	A												
3-2902-03	USA	MW-2-3	OU2	A												
3-2903-01	USA	MW-2-2	OU4	A												
3-2959-01	USA	MW-2-5		A												
3-3004-01	USA	MW-4-1	OU4	A												
3-3004-03	USA	MW-4-3	OU4	S												
3-3004-04	USA	MW-4-4	OU4	S												
3-3004-05	USA	MW-4-2A	OU4	A												
3-3100-02	USN	NCTAMS EASTPAC	OU2	A											Well being refurbished	
3-3102-02	Dole	Pump # 24		A			Pump out of service.				Pump out of service, sampled in Round 49					
3-3103-01	Del Monte	Pump # 5	OU4	A			Pump out of service, sampled in Round 45									
3-3203-02	Dole	Pump # 26 (Waialua Sugar Co.)	OU4	A											Electrical system down, sampled in Round 53	

Table 6.3: Network Wells Not Sampled
During Third Five-Year Review Period
Schofield Army Barracks

State Permit Well Number	Well Owner	Alternative Well Name/Number	Site	Current Monitoring Frequency	Round 54 (Semiannual) February 2010	Round 55 (Quarterly) June 2010	Round 56 (Annual) August 2010	Round 57 (Quarterly) November 2010	Round 58 (Semiannual) March 2011	Round 59 (Quarterly) May 2011	Round 60 (Annual) August 2011	Round 61 (Quarterly) December 2011
3-2600-03	BWS	Mililani III Well # 2 (BWS Unit #8)	OU2	A			Pump out of service, sampled in Round 58					
3-2603-01	HCC	Hawaii Country Club	OU2	A								
3-2702-05	USAF	Waikakalaua # 5	OU2	A								
3-2703-02	Del Monte	"Basal Well" (fka New M.W.)	OU2	A								
3-2800-03/01	BWS	Mililani I Well # 3 (BWS Unit #3)	OU2	A							Pump out of service	
3-2801-02	USA	MW-2-4	OU2	A			Pump out of service, sampled in Round 57					
3-2802-01	USA	MW-2-6	OU2	A								
3-2803-01	USA	Navy Kunia	OU2	S								
3-2803-05	Del Monte	Kunia Battery (Pump # 3)	OU2	Q				Not sampled due to funding issues				
3-2803-07	Del Monte	Kunia (Pump # 4)	OU2	S	Pump out of service, sampled in Round 55						Pump out of service	
3-2859-01/02	BWS	Mililani II Well # 1 (BWS Unit #5)	OU2	A			Pump out of Service				Pump out of service	
3-2900-02	USA	MW-2-1	OU2	A								
3-2901-01	USA	Schofield Shaft Monitoring Well	OU2	A			Not accessible				Not accessible	
3-2901-02	USA	Schofield Supply Well #1	OU2	S	Pump out of service							
3-2901-03	USA	Schofield Supply Well #2	OU2	S							Pump out of service	
3-2901-04	USA	Schofield Supply Well #3	OU2	S								
3-2901-10	USA	Schofield Supply Well #4	OU2	Q		Pump out of service	Pump out of Service	Not sampled due to funding issues				Pump out of service
3-2901-11/08	BWS	Wahiawa I Well # 1 (BWS Unit #1)	OU2	A			Pump out of Service				Pump out of service	
3-2901-12	BWS	Wahiawa I Well # 2	OU2	A								
3-2901-13	USA	MW-1-1	OU2	S								
3-2902-01	BWS	Wahiawa II Well # 1 (BWS Unit #1)	OU2	A								
3-2902-03	USA	MW-2-3	OU2	A								
3-2903-01	USA	MW-2-2	OU4	A								
3-2959-01	USA	MW-2-5		A								
3-3004-01	USA	MW-4-1	OU4	A								
3-3004-03	USA	MW-4-3	OU4	S								
3-3004-04	USA	MW-4-4	OU4	S								
3-3004-05	USA	MW-4-2A	OU4	A								
3-3100-02	USN	NCTAMS EASTPAC	OU2	A								
3-3102-02	Dole	Pump # 24		A								
3-3103-01	Del Monte	Pump # 5	OU4	A								
3-3203-02	Dole	Pump # 26 (Waialua Sugar Co.)	OU4	A								

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required yes	no	Comments	Date and Nature of Corrective Action
1. Facility Access Control System A. Security Fence				
1. Gaps Beneath Fence				
3/1/2007	X		Erosion under the fence and around the fence post foundations	Prior to May 2007 inspection - Soil was placed in gaps
5/31/2007	X		Gaps greater than 2 inches found beneath the western security fence	June 2007- Soil was placed in gaps
8/31/2007	X		Gaps beneath fence at northwestern side repaired	August 2007 - Soil placed in gaps
12/20/2007	X		Gaps beneath fence	Prior to February 2008 inspection - Soil was placed in gaps
2/8/2008		X	No deficiencies observed	
5/6/2008	X		Repaired animal burrow gap below fence	May 2008 - Animal burrow filled in
8/5/2008		X	Gap at bottom of fence near site entrance gate repaired	August 2008 - Soil placed in gaps
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009	X		Close gap at bottom on new fence fabric installed near northwestern drainage chute	Prior to August 2009 inspection - New fence fabric installed
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
2. Chain-Link Fabric				
3/1/2007	X		Intermeshing of the tall grass and weeds with the fencing	Prior to May 2007 inspection - Grass/weeds removed
5/31/2007	X		Holes in chain link fabric identified	Prior to August 2007 inspection - Holes repaired
8/31/2007	X		Fence severely damaged at the northwestern channel, outside of the landfill boundary	February 2008 - Fence repaired
12/20/2007	X		Damaged fence unrepaired at northwest channel	February 2008 - Fence repaired

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
2/8/2008	X		Repair chain-link fence at NW corner of site	February 2008 - Fence repaired
5/6/2008		X	Intact and fully functional	
8/5/2008		X	Intact and fully functional	
11/11/2008		X	Intact and fully functional	
2/10/2009		X	Intact and fully functional	
5/20/2009		X	Intact and fully functional	
8/13/2009		X	Intact and fully functional	
12/15/2009		X	Intact and fully functional	
2/8/2010		X	Intact and fully functional	
6/8/2010		X	Intact and fully functional	
8/2/2010		X	Intact and fully functional	
3/30/2011		X	Intact and fully functional	
5/16/2011		X	Intact and fully functional	
8/2/2011		X	Intact and fully functional	
3. Fence Posts				
3/1/2007	X		Erosion under the fence and around the fence post foundations	Prior to May 2007 inspection - Soil was placed in gaps
5/31/2007	X		A fence post footing in the northern drainage channel is exposed	June 2007 - Exposed fence post was covered
8/31/2007	X		Post severely damaged at the northwestern channel, outside the landfill boundary.	October 2007 - Post and erosion at base repaired
12/20/2007		X	Intact and fully functional	
2/8/2008		X	Intact and fully functional	
5/6/2008		X	Intact and fully functional	
8/5/2008		X	Bent/damaged fence posts along west fence line. Chain-link fabric is intact and adequately supported	Prior to February 2009 inspection - Fence posts repaired
11/11/2008		X	Bent/damaged fence posts along west fence line. Chain-link fabric is intact and adequately supported	Prior to February 2009 inspection - Fence posts repaired
2/10/2009		X	Intact and fully functional	
5/20/2009		X	Intact and fully functional	
8/13/2009		X	Intact and fully functional	
12/15/2009		X	Intact and fully functional	
2/8/2010		X	Intact and fully functional	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
6/8/2010		X	Intact and fully functional	
8/2/2010		X	Intact and fully functional	
3/30/2011		X	Intact and fully functional	
5/16/2011		X	Intact and fully functional	
8/2/2011		X	Intact and fully functional	
B. Site Access Gates				
1. Gate Locks				
3/1/2007		X	Intact and fully functional	
5/31/2007		X	Intact and fully functional	
8/31/2007		X	Original gate lock cut off and replaced with unauthorized lock. Lock replaced.	August 2007 - Lock replaced
12/20/2007		X	Intact and fully functional	
2/8/2008	X		Padlock mechanism at entrance gate needs oiling	Prior to May 2008 inspection - Lock was oiled
5/6/2008		X	Intact and fully functional	
8/5/2008		X	Intact and fully functional	
11/11/2008		X	Intact and fully functional	
2/10/2009		X	Intact and fully functional	
5/20/2009		X	Intact and fully functional	
8/13/2009		X	Intact and fully functional	
12/15/2009		X	Intact and fully functional	
2/8/2010		X	Intact and fully functional	
6/8/2010		X	Intact and fully functional	
8/2/2010		X	Intact and fully functional	
3/30/2011		X	Intact and fully functional	
5/16/2011		X	Intact and fully functional	
8/2/2011		X	Intact and fully functional	
2. Gate Operation				
3/1/2007		X	Intact and fully functional	
5/31/2007		X	Intact and fully functional	
8/31/2007		X	Intact and fully functional	
12/20/2007		X	Intact and fully functional	
2/8/2008		X	Intact and fully functional	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
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Inspection of	Action Required		Comments	Date and Nature of Corrective Action
	yes	no		
5/6/2008		X	Intact and fully functional	
8/5/2008		X	Intact and fully functional	
11/11/2008		X	Intact and fully functional	
2/10/2009		X	Intact and fully functional	
5/20/2009		X	Intact and fully functional	
8/13/2009		X	Intact and fully functional	
12/15/2009		X	Intact and fully functional	
2/8/2010		X	Intact and fully functional	
6/8/2010		X	Intact and fully functional	
8/2/2010		X	Intact and fully functional	
3/30/2011		X	Intact and fully functional	
5/16/2011		X	Intact and fully functional	
8/2/2011		X	Intact and fully functional	
C. Warning Signs				
3/1/2007		X	Intact and fully functional	
5/31/2007		X	Intact and fully functional	
8/31/2007		X	Intact and fully functional	
12/20/2007	X		Unreadable warning sign at entrance gate was replaced	December 2007 - Warning sign replaced
2/8/2008		X	Intact and fully functional	
5/6/2008		X	Intact and fully functional	
8/5/2008		X	Intact and fully functional	
11/11/2008		X	Intact and fully functional	
2/10/2009		X	Intact and fully functional	
5/20/2009		X	Intact and fully functional	
8/13/2009		X	Intact and fully functional	
12/15/2009		X	Intact and fully functional	
2/8/2010		X	Intact and fully functional	
6/8/2010		X	Intact and fully functional	
8/2/2010		X	Intact and fully functional	
3/30/2011		X	Intact and fully functional	
5/16/2011		X	Intact and fully functional	
8/2/2011		X	Intact and fully functional	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
D. Access Roads				
3/1/2007		X	Good condition with no potholes or traffic obstructions	
5/31/2007		X	Good condition with no potholes or traffic obstructions	
8/31/2007		X	Good condition with no potholes or traffic obstructions	
12/20/2007		X	Good condition with no potholes or traffic obstructions	
2/8/2008		X	Good condition with no potholes or traffic obstructions	
5/6/2008		X	Good condition with no potholes or traffic obstructions	
8/5/2008		X	Good condition with no potholes or traffic obstructions	
11/11/2008		X	Good condition with no potholes or traffic obstructions	
2/10/2009		X	Good condition with no potholes or traffic obstructions	
5/20/2009		X	Good condition with no potholes or traffic obstructions	
8/13/2009		X	Good condition with no potholes or traffic obstructions	
12/15/2009		X	Good condition with no potholes or traffic obstructions	
2/8/2010		X	Good condition with no potholes or traffic obstructions	
6/8/2010		X	Good condition with no potholes or traffic obstructions	
8/2/2010		X	Good condition with no potholes or traffic obstructions	
3/30/2011		X	Good condition with no potholes or traffic obstructions	
5/16/2011		X	Good condition with no potholes or traffic obstructions	
8/2/2011		X	Good condition with no potholes or traffic obstructions	
2. Runon/Runoff Controls				
A. Northern Runoff Control Berms				
3/1/2007		X	Thick grass and weeds are growing in area and need to be cut	Prior to May 2007 inspection - Grass/weeds cut
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
B. Center Drainage Channel				
3/1/2007	X		Cracks in the center drainage channel rip-rap concrete	Prior to May 2007 inspection - Cracks repaired
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009	X		Temporary berm at drain inlet constructed to prevent water flow to damaged drain line pipe on east slope. Low risk of water retention conditions exist over landfill cap; this would be mitigated by closing inlet pipe in berm or creating retention pond; numerous cracks in grouted rip rap at bottom of channel; cracks will be repaired during major repair effort for overall drainage system.	August 2009 - Berm constructed March 2010 - Cracks repaired/berm removed
12/15/2009	X		Temporary berm at drain inlet with open pipe. Numerous cracks in grouted rip rap at bottom of channel will be repaired during drainage channel repair.	August 2009 - Berm constructed March 2010 - Cracks repaired/berm removed
2/8/2010	X		Temporary berm at drain inlet with open pipe. Numerous cracks in grouted rip rap at bottom of channel. Will be repaired during drainage channel repair.	August 2009 - Berm constructed March 2010 - Cracks repaired/berm removed
6/8/2010	X		The central drainage channel was under repair	August 2009 - Berm constructed March 2010 - Cracks repaired/berm removed

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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
8/2/2010	X		The central drainage channel was under repair	August 2009 - Berm constructed March 2010 - Cracks repaired/berm removed
3/30/2011	X		The central drainage channel was repaired. Erosion control measures will be required for the barren areas.	August 2009 - Berm constructed March 2010 - Cracks repaired/berm removed
5/16/2011		X	Erosion control measures have been implemented and will need continued maintenance.	
8/2/2011		X	Erosion control measures have been implemented and will need continued maintenance.	
C. Northern Drainage Channel				
3/1/2007		X	Small to moderate amount of soil erosion around the channel near the fence area	June 2007 - Exposed soil was covered with erosion control material
5/31/2007		X	Exposed base soil at the end of the drainage channel	June 2007 - Exposed soil was covered with erosion control material
8/31/2007	X		Fire-damaged erosion control fabric replaced. Fallen tree on fence removed	August 2007 - Fabric replaced, and fallen tree removed
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	New black geo-fabric cover was installed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	Deteriorated erosion control mat was observed at the north end drainage.	May 2011 - Repaired erosion control mat
5/16/2011		X	Repaired erosion control mat was observed at the north end drainage.	May 2011 - Repaired erosion control mat
8/2/2011		X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
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Schofield Army Barracks

Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
D. Western Drainage Channel				
3/1/2007	X	X	Thick grass and weeds are growing in the area and need to be cut	Prior to May 2007 inspection - Grass/weeds cut
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
E. North-central Side Slope Drainage Chute				
3/1/2007		X	Thick grass and weeds are growing in the area and need to be cut	Prior to May 2007 inspection - Grass/weeds cut
5/31/2007		X	No deficiencies observed	
8/31/2007		X	Minor cracks on slope	Prior to December 2007 inspection - Cracks repaired
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	

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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
F. Northern Side Slope Drainage Chute				
3/1/2007		X	Thick grass and weeds are growing in the area and need to be cut	Prior to May 2007 inspection - Grass/weeds cut
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
G. Northwestern Side Slope Drainage Chute				
3/1/2007		X	Thick grass and weeds are growing in the area and need to be cut	Prior to May 2007 inspection - Grass/weeds cut
5/31/2007		X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
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Inspection of	Action Required		Comments	Date and Nature of Corrective Action
	yes	no		
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
3. Final Cover System (Top and Side Slopes)				
A. Vegetation Establishment				
1. Barren Areas				
3/1/2007	X		Isolated barren areas on the landfill cover require cultivation.	Prior to May 2007 inspection - Grass re-establishing
5/31/2007		X	No deficiencies observed	
8/31/2007		X	Fire-breaks were scraped onto the cover during fire. These areas are re-establishing with vegetation.	August 2007 - Observed grass re-establishing
12/20/2007	X		Fire-breaks were scraped onto the cover during fire. Continue re-establishing fire-breaks and various barren areas with vegetation.	December 2007 - Observed grass re-establishing
2/8/2008	X		Promote grass growth in barren areas	February 2008 - Observed grass re-establishing
5/6/2008	X		Promote grass growth in barren areas and in firebreaks that were scraped during summer 2007 brush fire. Barren areas are being hydroseeded	May 2008 - Grass replanted

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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
8/5/2008	X		Continue to promote grass growth in barren areas and in firebreaks cut during 2007 brush fire.	August 2008 - Observed grass re-establishing
11/11/2008	X		Continue to promote grass growth in barren areas and in firebreaks cut during 2007 brush fire.	November 2008 - Observed grass re-establishing
2/10/2009	X		Continue to promote grass growth in barren areas and in firebreaks cut during 2007 brush fire. Fewer barren areas noted than previous inspections. Spotty growth below first bench on east slope.	May 2009 - Observed grass re-establishing
5/20/2009	X		Continue to promote grass growth in isolated barren areas on east berms and in west drainage channel.	February 2009 - Observed grass re-establishing
8/13/2009		X	Isolated barren areas mulched and seeded to promote grass growth in west drainage channel and at east berms.	August 2009 - Grass replanted in west drainage channel and at east berm
12/15/2009		X	Isolated barren areas on the ridge to the north and east of the central drainage channel.	
2/8/2010		X	Isolated barren areas on the ridge to the north and east of the central drainage channel.	
6/8/2010		X	Isolated barren areas on the ridge to the west (due to construction equipment transportation) and north of the central drainage channel. Vegetation was recently cleared to access the central drainage channel repair area.	
8/2/2010		X	Isolated barren areas were visible near the central drainage channel, and on the ridge to the east and north of the central drainage channel, and on the ridge to the east and north of the central drainage channel. More vegetation was cleared on the central drainage channel repair area. Stressed vegetation was visible in many areas of the landfill.	
3/30/2011		X	Isolated barren areas were visible near the central drainage channel, and on the ridge to the east and north of the central drainage channel. Overall condition was good throughout the landfill, except for a few areas where stressed ground cover was visible.	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
5/16/2011	X		Overall conditions were good throughout the landfill, except for a few areas where stressed ground cover was visible to the west of the central drainage channel.	May 2011 - Observed grass re-establishing
8/2/2011		X	Overall conditions were good throughout the landfill. Increased vegetative growth was observed in the previous	
2. Guinea Grass and other Invasive Weeds				
3/1/2007	X		Dense Guinea grass and invasive weeds growing in the areas of the northern runoff control berms, western drainage channel, north-central side slope drainage chute, northern side slope drainage chute and northwestern side slope drainage chute.	Prior to May 2007 inspection - Control measures in place for grass/weeds
5/31/2007		X	Under control	
8/31/2007		X	Under control	
12/20/2007	X		Maintenance crew cutting Guinea grass on east embankment at time of inspection.	December 2007 - Grass cut
2/8/2008	X		Guinea grass on side slope growing quickly. Cutting may be required soon.	Prior to May 2008 inspection - Grass cut
5/6/2008	X		Guinea grass on east slope is growing quickly. Cut regularly.	Prior to May 2008 inspection - Grass cut
8/5/2008	X		Guinea grass below first slope bench may need cutting soon. Grass cutting on lower slopes in progress	August 2008 - Grass cut
11/11/2008	X		Continue cutting slope below first bench on regularly scheduled basis	November 2008 - Grass cut
2/10/2009		X	Under control	
5/20/2009	X		Cut guinea grass at central drainage channel headwall	August 2009 - Grass cut
8/13/2009		X	Guinea grass over much of landfill surface. This is not considered a critical issue as long as the height is controlled. Vegetation will be maintained at an average height no greater than 8 to 12 inches, an optimum range for the mower used on site. Cap vegetation was cut in August 2009.	August 2009 - Grass cut
12/15/2009		X	Under control	
2/8/2010		X	Under control	

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Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
6/8/2010		X	Under control	
8/2/2010		X	Under control	
3/30/2011		X	Under control	
5/16/2011		X	Under control	
8/2/2011		X	Under control	
3. Tree Growth				
3/1/2007		X	No deficiencies observed. Large tree observed at west end of landfill	March 2007 - Tree will remain in place
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
B. Slope Failure/Slumping				
3/1/2007		X	Slope erosion at west drainage channel	Prior to May 2007 inspection - Slope erosion repaired
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	

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Inspection of	Action Required		Comments	Date and Nature of Corrective Action
	yes	no		
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
C. Cracking/Settlement				
3/1/2007		X	No deficiencies observed	
5/31/2007	X		Cracks on landfill cap of approximate 1 to 2 inches width	June 2007 - Cracks were repaired
8/31/2007		X	Desiccation cracks in surface barren areas repaired	Prior to December 2007 inspection - Cracks repaired
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	Surficial shrinkage cracks noted in barren areas. Irrigation system being augmented to increase moisture to cover barren areas and reduce surficial shrinkage cracks	August 2008 - Cracks repaired
8/5/2008		X	Cracks noted at several locations on landfill cover at south end. Cracks repaired	August 2008 - Cracks repaired
11/11/2008		X	Cracks in southeast section, contract for repairs awarded	August 2008 - Cracks repaired
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
D. Erosion Damage				
3/1/2007		X	No deficiencies observed	
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009	X		Recent heavy rains caused severe erosion damage on east slope along alignment of buried storm drain pipe from center drainage channel. Negotiations for repair are ongoing.	August 2010 - Erosion damaged repaired
5/20/2009	X		Repairs to the erosion damage break on the east slope are still pending. Negotiations for repair are ongoing.	August 2010 - Erosion damaged repaired
8/13/2009	X		Repairs to the erosion damage and drain line break on the east slope are scheduled for Spring 2010	August 2010 - Erosion damaged repaired
12/15/2009	X		Repairs to the erosion damage and drainline break on the east slope are still pending. Repair is scheduled for Spring 2010.	August 2010 - Erosion damaged repaired
2/8/2010	X		Repairs to the erosion damage and drainline break on the east slope are still pending. Repairs scheduled for March 2010.	August 2010 - Erosion damaged repaired
6/8/2010	X		The central drainage channel was under repair.	August 2010 - Erosion damaged repaired
8/2/2010	X		The central drainage channel was under repair.	August 2010 - Erosion damaged repaired
3/30/2011	X		The central drainage channel was repaired. However, erosion control measures will be required for the barren areas and rain damage.	Prior to August 2011 - Erosion control repaired

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required		Comments	Date and Nature of Corrective Action
	yes	no		
5/16/2011	X		Erosion control measures will be required for the barren areas and rain damage on the northeast slope behind the landfill.	Prior to August 2011 - Erosion control repaired
8/2/2011	X		No deficiencies observed	Prior to August 2011 - Erosion control repaired
E. Debris Accumulation				
3/1/2007	X		Debris is accumulated at center and northern drainage	Prior to May 2007 inspection - Debris removed
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008	X		Accumulated debris in north channel has been removed	May 2008 - Debris removed
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	Stockpiled soil protected by a silt fence was visible near the central drainage channel.	
5/16/2011		X	Stockpiled soil protected by a silt fence was visible near the central drainage channel.	
8/2/2011		X	Stockpiled soil protected by a silt fence was visible near the central drainage channel.	
F. Animal Burrows				
3/1/2007		X	No deficiencies observed	
5/31/2007		X	No deficiencies observed	
8/31/2007		X	Animal burrows near western drainage	
12/20/2007	X		Animal burrows near western drainage was filled	December 2007 - Animal burrows were filled in

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required		Comments	Date and Nature of Corrective Action
	yes	no		
2/8/2008		X	Collapse or fill animal burrow at NW corner of landfill	December 2007 - Animal burrows were filled in
5/6/2008	X		Animal burrow gap below fence has been filled	December 2007 - Animal burrows were filled in
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
G. Fire/Explosion Damage				
3/1/2007		X	No deficiencies observed	
5/31/2007		X	No deficiencies observed	
8/31/2007	X		Vegetation re-establishing on fire damaged areas within landfill boundaries	August 2007 - Observed vegetation re-establishing
12/20/2007		X	Continue re-establishing vegetation on fire damaged areas within landfill boundaries	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	
4. Gas Monitoring/Control System				
A. Well Casing and Cap				
3/1/2007		X	Intact and fully functional	
5/31/2007		X	Intact and fully functional	
8/31/2007		X	Intact and fully functional	
12/20/2007		X	Gas monitoring discontinued in August 2007	
2/8/2008		X	Gas monitoring discontinued in August 2007	
5/6/2008		X	Gas monitoring discontinued in August 2007	
8/5/2008		X	Gas monitoring discontinued in August 2007	
11/11/2008		X	Gas monitoring discontinued in August 2007	
2/10/2009		X	Gas monitoring discontinued in August 2007	
5/20/2009		X	Gas monitoring discontinued in August 2007	
8/13/2009		X	Gas monitoring discontinued in August 2007	
12/15/2009		X	Gas monitoring discontinued in August 2007	
2/8/2010		X	Gas monitoring discontinued in August 2007	
6/8/2010		X	Gas monitoring discontinued in August 2007	
8/2/2010		X	Gas monitoring discontinued in August 2007	
3/30/2011		X	Gas monitoring discontinued in August 2007	
5/16/2011		X	Gas monitoring discontinued in August 2007	
8/2/2011		X	Gas monitoring discontinued in August 2007	
B. Protective Casing				
3/1/2007		X	Intact and fully functional	
5/31/2007		X	Intact and fully functional	
8/31/2007		X	Intact and fully functional	
12/20/2007		X	Gas monitoring discontinued in August 2007	
2/8/2008		X	Gas monitoring discontinued in August 2007	
5/6/2008		X	Gas monitoring discontinued in August 2007	
8/5/2008		X	Gas monitoring discontinued in August 2007	
11/11/2008		X	Gas monitoring discontinued in August 2007	
2/10/2009		X	Gas monitoring discontinued in August 2007	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required yes	Action Required no	Comments	Date and Nature of Corrective Action
5/20/2009		X	Gas monitoring discontinued in August 2007	
8/13/2009		X	Gas monitoring discontinued in August 2007	
12/15/2009		X	Gas monitoring discontinued in August 2007	
2/8/2010		X	Gas monitoring discontinued in August 2007	
6/8/2010		X	Gas monitoring discontinued in August 2007	
8/2/2010		X	Gas monitoring discontinued in August 2007	
3/30/2011		X	Gas monitoring discontinued in August 2007	
5/16/2011		X	Gas monitoring discontinued in August 2007	
8/2/2011		X	Gas monitoring discontinued in August 2007	
C. Grout Seal				
3/1/2007		X	Intact and fully functional	
5/31/2007		X	Intact and fully functional	
8/31/2007		X	Intact and fully functional	
12/20/2007		X	Intact and fully functional	
2/8/2008		X	Intact and fully functional	
5/6/2008		X	Intact and fully functional	
8/5/2008		X	Intact and fully functional	
11/11/2008		X	Intact and fully functional	
2/10/2009		X	Intact and fully functional	
5/20/2009		X	Intact and fully functional	
8/13/2009		X	Intact and fully functional	
12/15/2009		X	Intact and fully functional	
2/8/2010		X	Intact and fully functional	
6/8/2010		X	Intact and fully functional	
8/2/2010		X	Intact and fully functional	
3/30/2011		X	Intact and fully functional	
5/16/2011		X	Intact and fully functional	
8/2/2011		X	Intact and fully functional	
5. Groundwater Monitoring System				
A. Monitoring Wells				
1. Well Casing and Cap				
3/1/2007		X	Intact and fully functional	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required		Comments	Date and Nature of Corrective Action
	yes	no		
5/31/2007		X	Intact and fully functional	
8/31/2007		X	Intact and fully functional	
12/20/2007		X	Intact and fully functional	
2/8/2008		X	Intact and fully functional	
5/6/2008		X	Intact and fully functional	
8/5/2008		X	Intact and fully functional	
11/11/2008		X	Intact and fully functional	
2/10/2009		X	Intact and fully functional	
5/20/2009		X	Intact and fully functional	
8/13/2009		X	Intact and fully functional	
12/15/2009		X	Intact and fully functional	
2/8/2010		X	Intact and fully functional	
6/8/2010		X	Intact and fully functional	
8/2/2010		X	Intact and fully functional	
3/30/2011		X	Intact and fully functional	
5/16/2011	X		Well GP-4 is not secured because the lid is corroded.	Prior to August 2011 - GP-4 lid repaired
8/2/2011		X	Intact and fully functional	
2. Protective Casing				
3/1/2007		X	Intact and fully functional	
5/31/2007		X	Intact and fully functional	
8/31/2007		X	Repairs to protective casings damage are complete	August 2007 - Protective casings repaired
12/20/2007		X	Intact and fully functional	
2/8/2008		X	Intact and fully functional	
5/6/2008		X	Intact and fully functional	
8/5/2008		X	Intact and fully functional	
11/11/2008		X	Intact and fully functional	
2/10/2009		X	Intact and fully functional	
5/20/2009		X	Intact and fully functional	
8/13/2009		X	Intact and fully functional	
12/15/2009		X	Intact and fully functional	
2/8/2010		X	Intact and fully functional	
6/8/2010		X	Intact and fully functional	
8/2/2010		X	Intact and fully functional	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required		Comments	Date and Nature of Corrective Action
	yes	no		
3/30/2011		X	Intact and fully functional	
5/16/2011		X	Intact and fully functional	
8/2/2011		X	Intact and fully functional	
3. Locks				
3/1/2007		X	No deficiencies observed	
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	
2/10/2009		X	Padlock on MW4-3 could not be opened with known combinations on record. Lock was cut and replaced.	February 2009- Lock replaced
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011	X		Well GP-1 is missing a security lock	Prior to August 2011 - Lock replaced
8/2/2011		X	Intact and fully functional	
4. Grout Seal				
3/1/2007		X	No deficiencies observed	
5/31/2007		X	No deficiencies observed	
8/31/2007		X	No deficiencies observed	
12/20/2007		X	No deficiencies observed	
2/8/2008		X	No deficiencies observed	
5/6/2008		X	No deficiencies observed	
8/5/2008		X	No deficiencies observed	
11/11/2008		X	No deficiencies observed	

Table 6.4: Summary of Landfill Quarterly Inspection Reports Observations
December 2006 through December 2011
Third Five Year Review Period
Schofield Army Barracks

Inspection of	Action Required		Comments	Date and Nature of Corrective Action
	yes	no		
2/10/2009		X	No deficiencies observed	
5/20/2009		X	No deficiencies observed	
8/13/2009		X	No deficiencies observed	
12/15/2009		X	No deficiencies observed	
2/8/2010		X	No deficiencies observed	
6/8/2010		X	No deficiencies observed	
8/2/2010		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
3/30/2011		X	No deficiencies observed	
5/16/2011		X	No deficiencies observed	
8/2/2011		X	No deficiencies observed	

Table 8.1: Issues Regarding Remedies for Operable Unit 2 and Operable Unit 4 Third Five-Year Review Period Schofield Army Barracks

Issue	Affects Current Protectiveness?	Affects Future Protectiveness ?
Operable Unit 2		
Sandwich Isles Communications Air Stripper has been built to treat groundwater for agricultural use. Water is tested regularly.	No	No
Other wells may be installed and should be tested before use as a domestic water source.	No	Yes
Operable Unit 4		
Minor landfill cover cracking, degradation of erosion matting, barren spots and erosion around fence are maintenance issues that are handled through an ongoing maintenance program.	No	No

Table 9.1: Contingency Plan for Sampling Wells in Long-Term Monitoring Network
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Use	Depth Open Interval (msl)	Contingency if Pump is Non-Functional or if Access is Blocked or Denied
3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply	-40 to -150	Sample Kipapa-7 (1/2 mi downgradient)
3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply	-32 to -246	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event.
3-2702-05	OU 2 Offsite Monitoring Well	20 to 0	Sample Well 2702-03 (17 to -3 ft msl) or 2702-04 (32 to 12 ft msl)
3-2703-02 (Del Monte)	OU 2 Offsite Irrigation Well	Unknown	Sample Well 2703-01 (221 to -129 ft msl)
3-2800-03	OU 2 Offsite Domestic/Municipal Water Supply	-48 to -262	Sample Well 2800-01 (unknown open interval) or -02 (-40 to -250 ft msl)
3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well	284 to 134	No adjacent well; repair pump as soon as possible and sample in next quarterly monitoring event
3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well	Unknown	No adjacent well, repair pump as soon as possible and sample in next quarterly monitoring event
3-2803-01	OU 2 Offsite Industrial Well	bottom at -154	Sample Well 2803-05 (196 to -163 ft msl)
3-2803-05 (Del Monte)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	196 to -163	Sample Well 2803-01 (to -154 ft msl) or 2803-07 (42 to -118 ft msl)
3-2803-07 (Del Monte)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	42 to -118	Sample Well 2803-01 (to -154 ft msl) or 2803-05 (196 to -163 ft msl)
3-2859-01	OU 2 Offsite Domestic/Municipal Water Supply Well	-40 to -160	Sample Well 2859-02 (-40 to -150 ft msl)
3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well	283 to 133	No adjacent well; repair pump as soon as possible and sample in next quarterly monitoring event
3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well	277 to 147	Use data from adjacent supply well
3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well	277 to 137	Use data from adjacent supply well
3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well	277 to 83	Use data from adjacent supply well
3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well	277 to 23	Use data from adjacent supply well
3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well	277 to 9	Use data from adjacent supply well
3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply	Unknown	Sample Well 2901-12 (174 to 16 ft msl) or 2901-08 (220 to -10 ft msl)
3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply	174 to 16	Sample Well 2901-11 (unknown open interval) or 2901-08 (220 to -10 ft msl)
3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well	266 to 186	Use data from adjacent Schofield supply wells 2901-01 or 2901-02
3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply	80 to -120	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event.
3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well	284 to 134	No adjacent well; repair pump as soon as possible and sample in next quarterly monitoring event
3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well	283 to 133	No adjacent well; repair pump as soon as possible and sample in next quarterly monitoring event

Table 9.1: Contingency Plan for Sampling Wells in Long-Term Monitoring Network
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Use	Depth Open Interval (msl)	Contingency if Pump is Non-Functional or if Access is Blocked or Denied
3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well	285 to 135	No adjacent well; repair pump as soon as possible and sample in next quarterly monitoring event
3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well	281 to 231	Use data from Well 3004-03 (4-3)
3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well	284 to 234	Use data from Well 3004-01 (4-1)
3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well	628 to 60	No adjacent well with same producing interval
3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well	284 to 234	Use data from Well 3004-01 (4-1) or 3004-03 (4-3)
3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply	217 to 175	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event.
3-3102-02	OU 2 Offsite Irrigation Well	143 to -17	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event.
3-3103-01	OU 4 Offsite Irrigation Well	231 to -101	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event.
3-3203-02	OU 2 Offsite Irrigation Well	-46 to -196	No adjacent well; If pump is non-functional, contact owner to assess when repairs will be made; If repair can be made prior to upcoming sampling event, include in sampling network. If no access, an attempt will be made to resolve the issue in time for the upcoming sampling event. If access issues are not resolved, well will be scheduled for sampling during the next event.

msl - Mean sea level
OU - Operable Unit

Table 9.2: Recommended Monitoring Frequencies
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Current Monitoring Frequency	Recommended Monitoring Frequency
3-2600-03	OU 2 Offsite Domestic/Municipal Water Supply	Stable; <1 µg/L	<1 µg/L; stable	Annual	Annual
3-2603-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable; <1 µg/L	<1 µg/L; stable	Annual	Annual
3-2702-05	OU 2 Offsite Monitoring Well	Increasing trend; <5 µg/L	<1 µg/L; stable	Annual	Annual
3-2703-02 (Del Monte Basal)	OU 2 Offsite Irrigation Well	Slight increasing trend since October 2008; <1 µg/L	<1 µg/L; stable	Annual	Annual
3-2800-03/3-2800-01*	OU 2 Offsite Domestic/Municipal Water Supply	Stable; <5 µg/L	<1 µg/L; stable	Annual	Annual
3-2801-02 (MW-2-4)	OU 2 Onsite Monitoring Well	In the plume; increasing trend since August 2009	<1 µg/L; stable	Annual	Annual
3-2802-01 (MW-2-6)	OU 2 Onsite Monitoring Well	In the plume; slight increasing trend since November 2009; <5 µg/L	< 5 µg/L; slight increasing trend since November 2009	Annual	Annual
3-2803-01	OU 2 Offsite Industrial Well	In the plume; increase to 4 µg/L in 2010. Decreased to <1 µg/L in 2011.	CCl_4 concentrations increased above 1 µg/L in November 2005; <1 µg/L since then	Semiannual	Semiannual
3-2803-05 (Del Monte #3)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	In the plume; gradual increasing trend; >5 µg/L in 2011	CCl_4 concentrations increased above 1 µg/L in November 2005; <2.5 µg/L and gradual increasing trend since then	Quarterly	Quarterly

Table 9.2: Recommended Monitoring Frequencies
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Current Monitoring Frequency	Recommended Monitoring Frequency
3-2803-07 (Del Monte #4)	OU 2 Offsite Irrigation/Municipal Water-Supply Well	In the plume; >2.5 µg/L, increasing trend since 2005.	<1 µg/L; stable	Semiannual	Semiannual
3-2859-01	OU 2 Offsite Domestic/Municipal Water Supply Well	<1 µg/L; stable; last sampled in August 2009	<1 µg/L; stable; last sampled in August 2009	Annual	Annual
3-2900-02 (MW-2-1)	OU 2 Onsite Monitoring Well	In the plume; >10 µg/L, increasing trend since August 2009	<1 µg/L; stable	Annual	Annual
3-2901-01 (Shaft Monitoring Well)	OU 2 Onsite Schofield Barracks Monitoring Well	In the plume; stable; <1 µg/L, last sampled in August 2009	<1 µg/L; stable; last sampled in August 2009	Annual	Annual
3-2901-02 (Supply Well 1)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L, stable	<1 µg/L; stable	Semiannual	Semiannual
3-2901-03 (Supply Well 2)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L, stable	<1 µg/L; stable	Semiannual	Semiannual
3-2901-04 (Supply Well 3)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L, stable	<1 µg/L; stable	Semiannual	Semiannual
3-2901-10 (Supply Well 4)	OU 2 Onsite Schofield Barracks Water-Supply Well	In the plume; >10 µg/L; increased to > 60 µg/L in August 2005 and May 2011; generally fluctuating between 35 and 55 µg/l	<1 µg/L; stable	Quarterly	Quarterly

Table 9.2: Recommended Monitoring Frequencies
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Current Monitoring Frequency	Recommended Monitoring Frequency
3-2901-11	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable; last sampled in August 2007	<1 µg/L; stable; last sampled in August 2007	Annual	Annual
3-2901-12	OU 2 Offsite Domestic/Municipal Water Supply	<1 µg/L; stable	<1 µg/L; stable	Annual	Annual
3-2901-13 (MW-1-1)	OU 2 Onsite Monitoring Well	In the plume, generally <5 µg/L; exceeded 2.5 µg/L since Aug. 2009; exceeded 5 µg/L in Aug. 2010 and March 2011.	<1 µg/L; stable	Semiannual	Semiannual
3-2902-01	OU 2 Offsite Domestic/Municipal Water Supply	Stable, <1 µg/L	<1 µg/L; stable	Annual	Annual
3-2902-03 (MW-2-3)	OU 2 Onsite Monitoring Well	In the plume; >5 µg/l; slight decreasing trend	In the plume; stable; <2.5 µg/L	Annual	Annual
3-2903-01 (MW-2-2)	OU 4 Onsite Monitoring Well	Downgradient of landfill; stable; <1 µg/L	<1 µg/L; stable	Annual	Annual
3-2959-01 (MW-2-5)	OU 2 Onsite Monitoring Well	In the plume; <1 µg/L; very slight decreasing trend	<1 µg/L; stable	Annual	Annual
3-3004-01 (MW-4-1)	OU 4 Onsite Monitoring Well	Landfill well; >10 µg/L; Decreasing trend; Consider increasing the sampling frequency back to semiannual if TCE >30 µg/L.	Landfill well; <5 µg/L; Gradual decreasing trend since 1995. Consider increasing the sampling frequency back to semiannual if CCl_4 >6 µg/L.	Annual	Annual

Table 9.2: Recommended Monitoring Frequencies
Third Five-Year Review Period
Schofield Army Barracks

Well Name	Operable Unit and Well Type	TCE Trend Evaluation	CCl_4 Trend Evaluation	Current Monitoring Frequency	Recommended Monitoring Frequency
3-3004-03 (MW-4-3)	OU 4 Onsite Monitoring Well	Landfill well; >5 µg/L; Increasing trend through 2006, generally decreasing since then; increased in August 2011	Landfill well. >2.5 µg/L but <5 µg/L; stable	Semiannual	Semiannual
3-3004-04 (MW-4-4)	OU 4 Onsite Monitoring Well	Landfill well; >5 µg/L; Increasing trend until 1998; concentrations between 20 and 30 µg/L since then	Landfill well; >2.5 µg/L but <5 µg/L; possible current increasing trend	Semiannual	Semiannual
3-3004-05 (MW-4-2A)	OU 4 Onsite Monitoring Well	Landfill well; Increasing from 2003 through 2006, but <2.5 µg/L; decreasing trend since then	<1 µg/L; stable	Annual	Annual
3-3100-02	OU 2 Offsite Domestic/Municipal Water Supply	< 1 µg/L; stable	< 1 ug/L; stable	Annual	Annual
3-3102-02	OU 2 Offsite Irrigation Well	<1 µg/L; stable	<1 µg/L; stable	Annual	Annual
3-3103-01	OU 4 Offsite Irrigation Well	Downgradient of landfill; <1 µg/L; stable	<1 µg/L; stable	Annual	Annual
3-3203-02	OU 2 Offsite Irrigation Well	< 1 µg/L; stable	<1 µg/L; stable	Annual	Annual

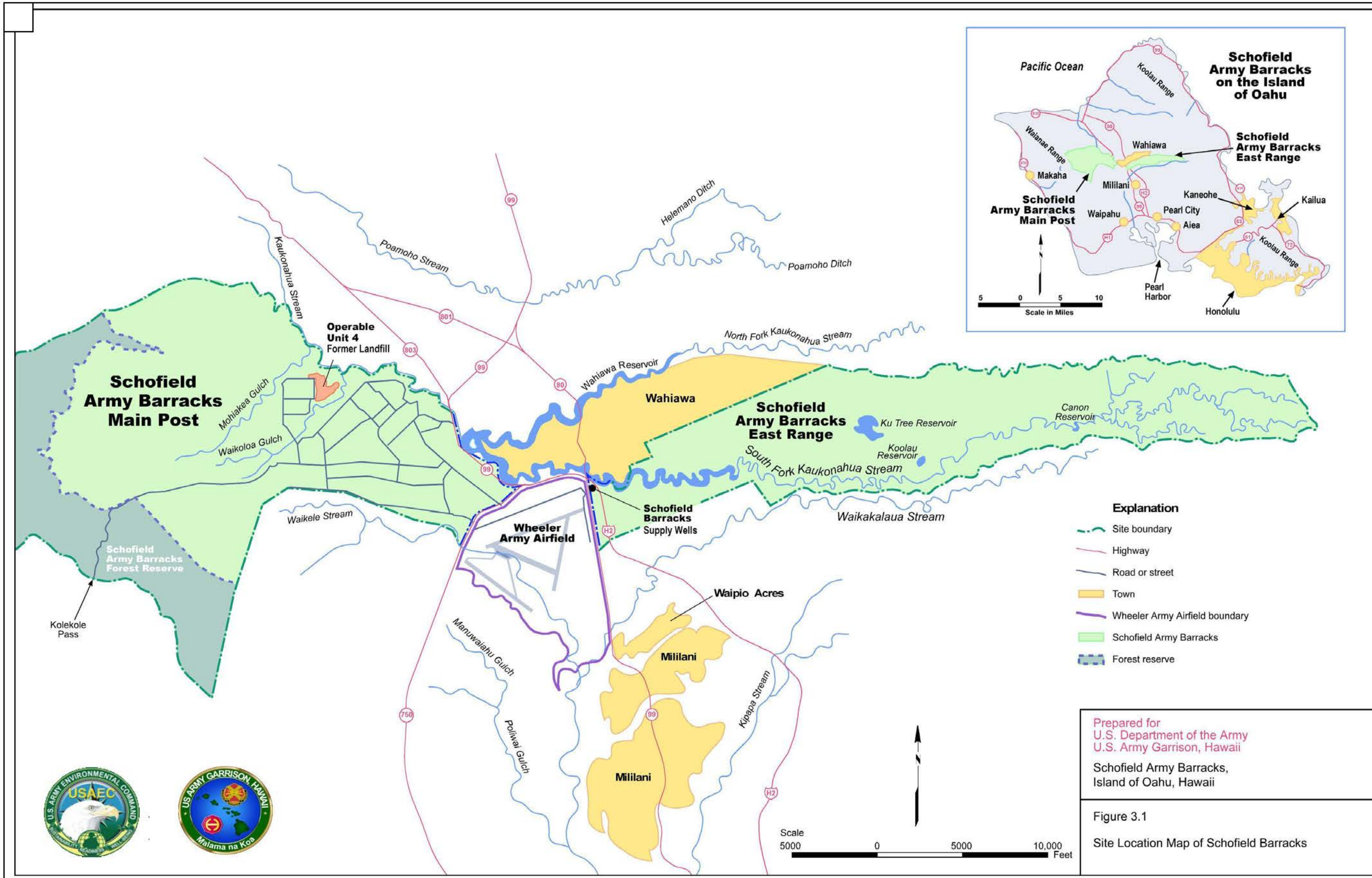
Notes:
CCl_4 - Carbon Tetrachloride
TCE - Trichloroethene
µg/L - Micrograms per liter
OU - Operable Unit
TCE - Trichloroethene

* Well was sampled as a substitute for a comparable well that was out of service.

Table 9.3: Recommendations and Follow Up Actions for Operable Unit 2 and Operable Unit 4
Third Five-Year Review Period
Schofield Army Barracks

Issue or Deficiency	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current?	Future?
Operable Unit 2						
One new irrigation well has been placed inside the plume boundary and three wells have been placed outside the plume boundary but within the extended monitoring well boundary.	Evaluate the wells for inclusion in the monitoring well network and improve the implementation of the ICs with better coordination with the State of Hawaii water well permitting program.	Army	State/EPA	31 December 2012	No	Yes

Operable Unit 4						
None						



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U.S. Army Garrison, Hawaii

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Island of Oahu, Hawaii

Figure 3.1

Site Location Map of Schofield Barracks

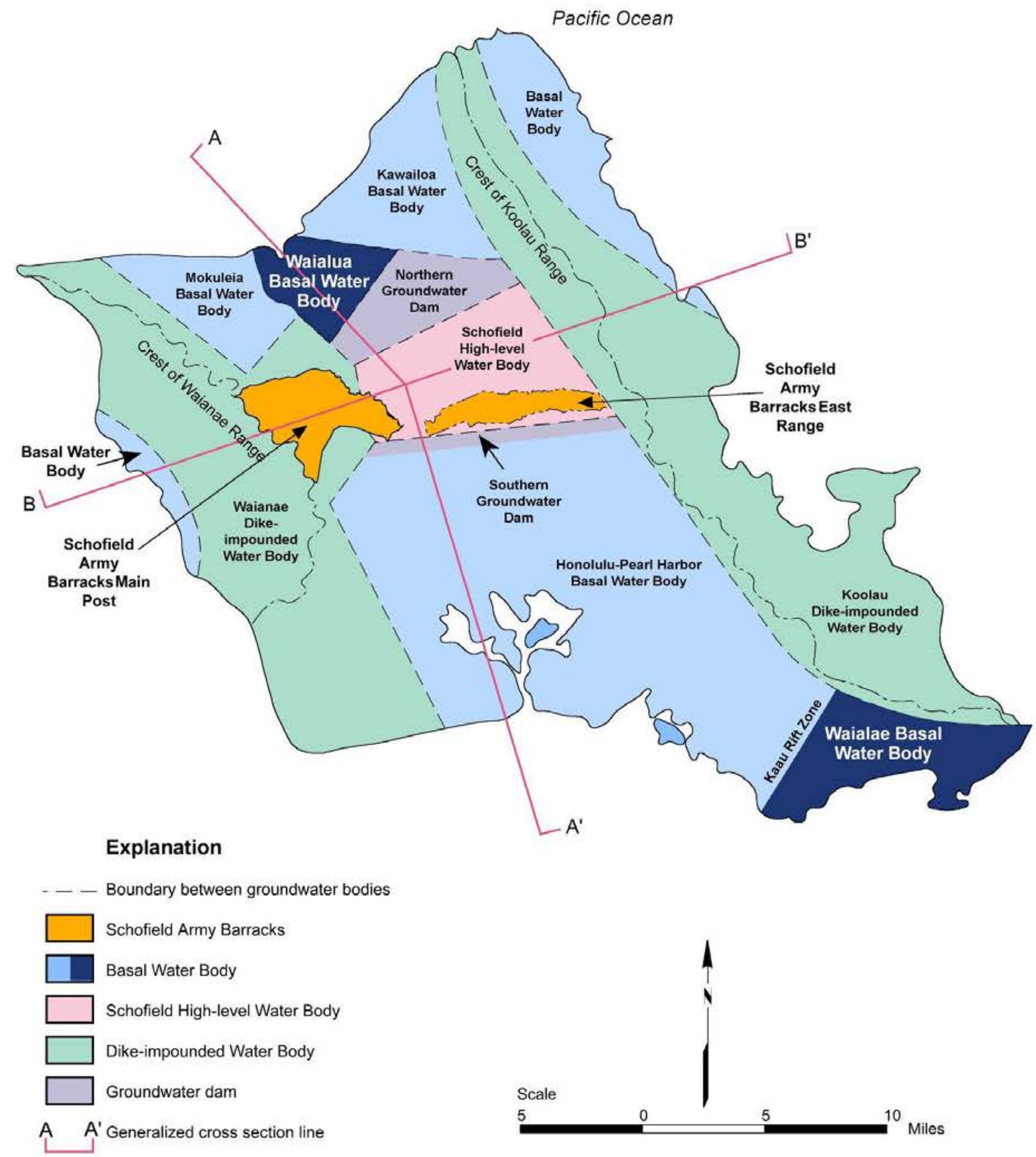

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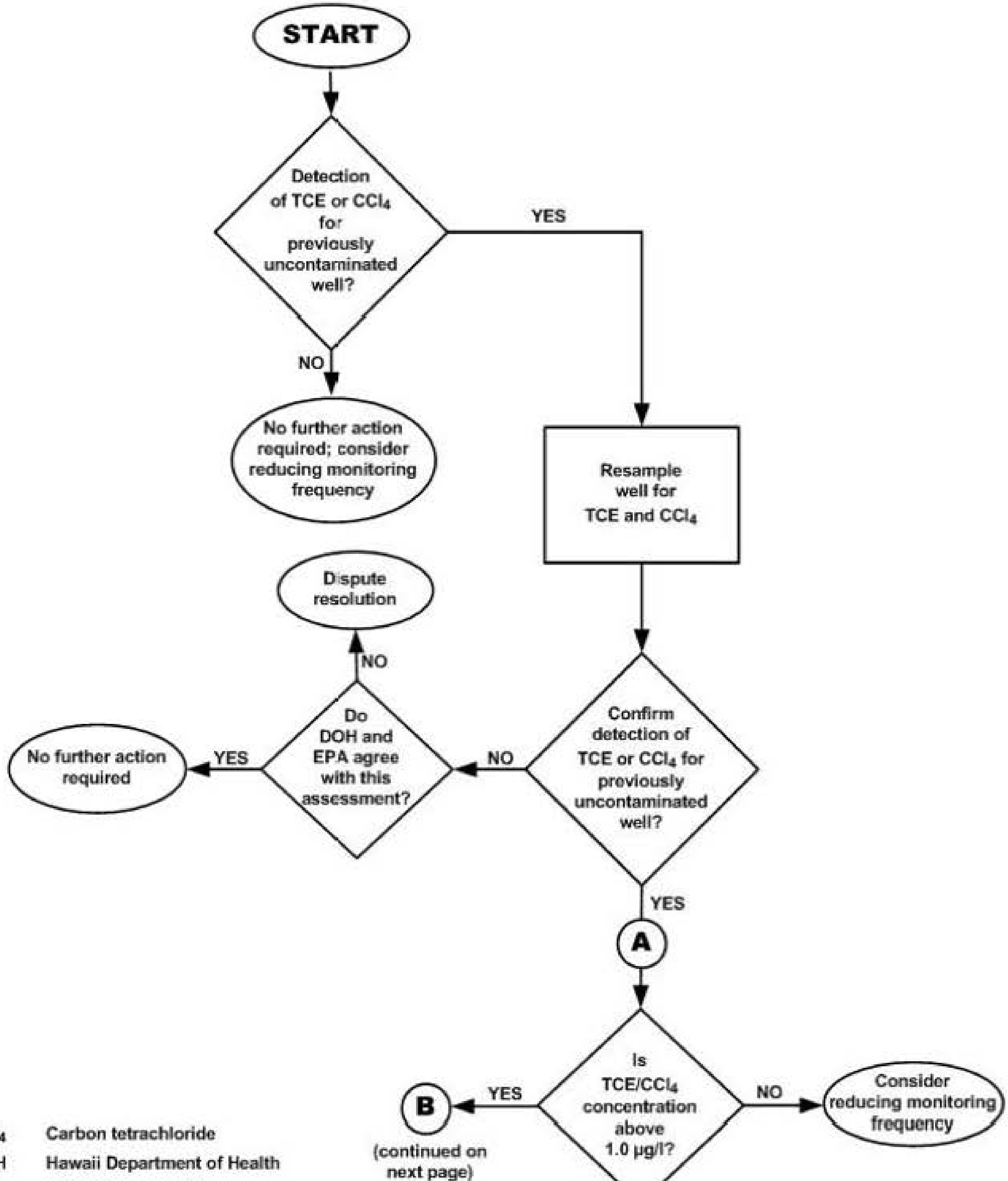
Figure 3.2

Regional Groundwater Systems of Oahu, Hawaii



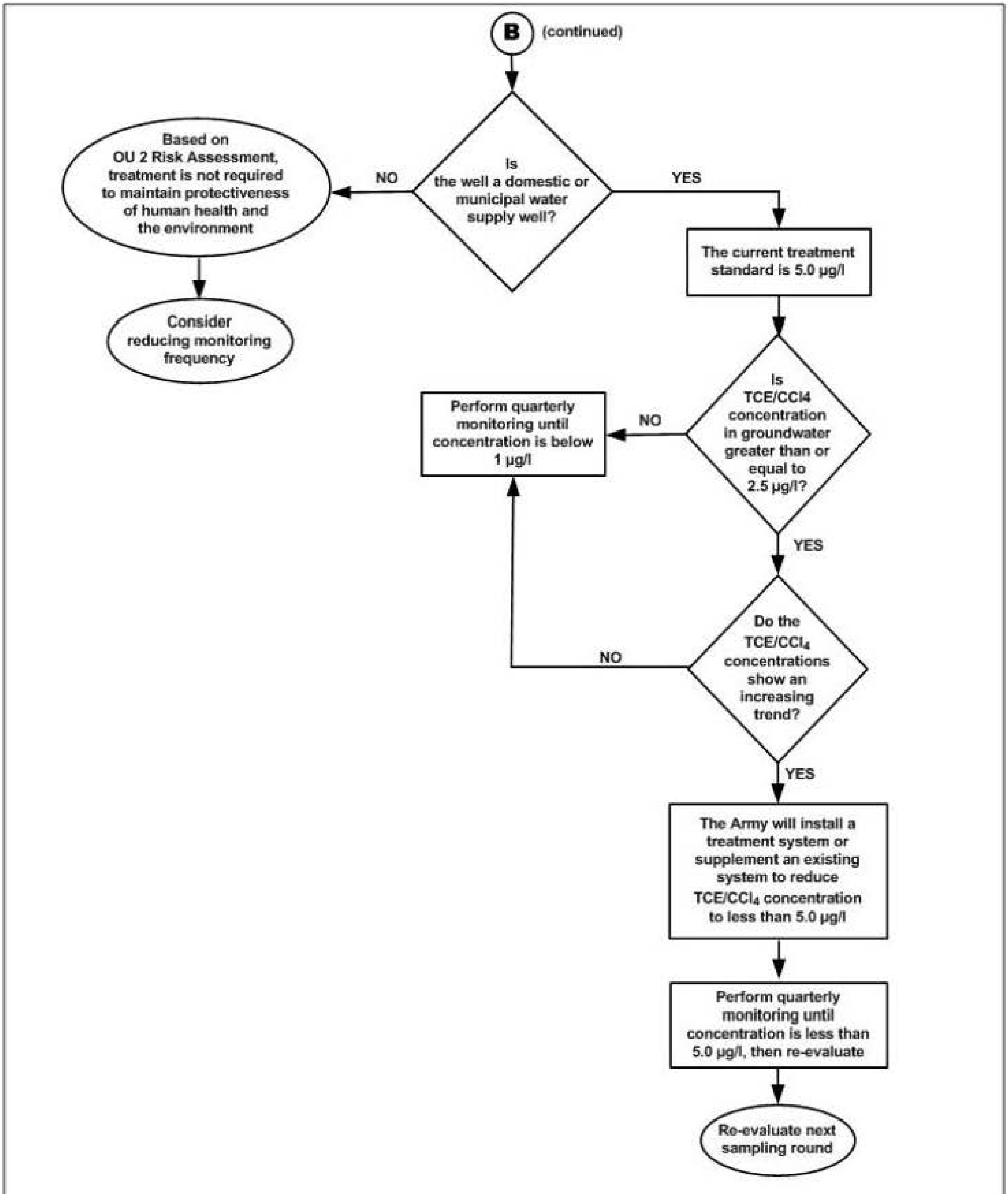
CCl_4	Carbon tetrachloride
DOH	Hawaii Department of Health
EPA	U.S. Environmental Protection Agency
TCE	Trichloroethene
µg/l	Micrograms per liter

Evaluation for Potential Wellhead Groundwater Treatment

FIGURE 4.1

Prepared for:
U.S. Department of the Army, U.S. Army Garrison, Hawaii
Schofield Army Barracks, Island of Oahu, Hawaii

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PBK	4663070005	KLC	2/24/07	

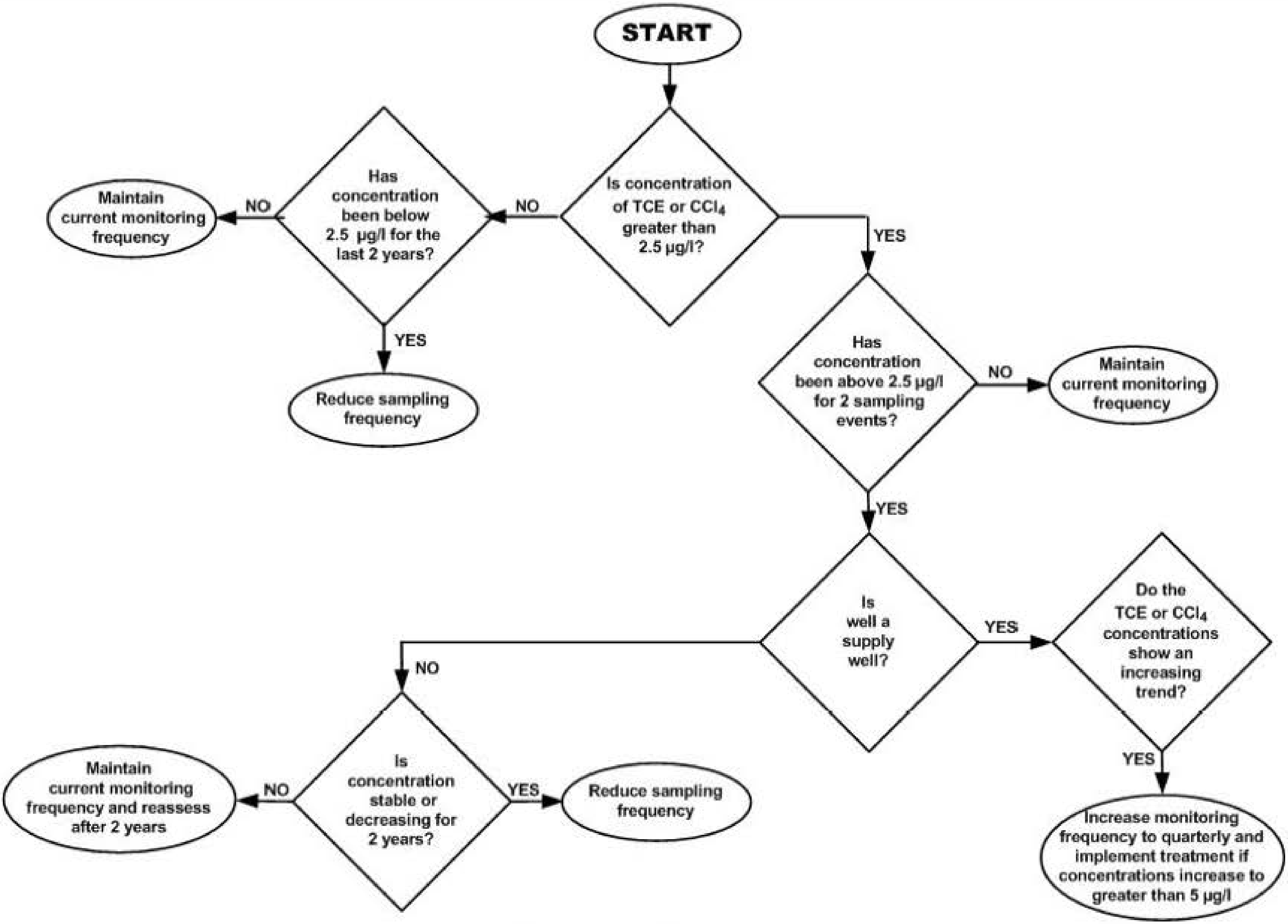


Evaluation for Potential Wellhead Groundwater Treatment

Prepared for:
U.S. Department of the Army, U.S. Army Garrison, Hawaii
Schofield Army Barracks, Island of Oahu, Hawaii

FIGURE 4.1 (continued)

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PBK	4663070005	KLC	2/24/07	



CCl_4	Carbon tetrachloride
TCE	Trichloroethene
µg/l	Micrograms per liter

Assessment of Changes in Monitoring Frequency

FIGURE 4.2

Prepared for:
U.S. Department of the Army, U.S. Army Garrison, Hawaii
Schofield Army Barracks, Island of Oahu, Hawaii

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PBK	4663070005	KLC	2/24/07	

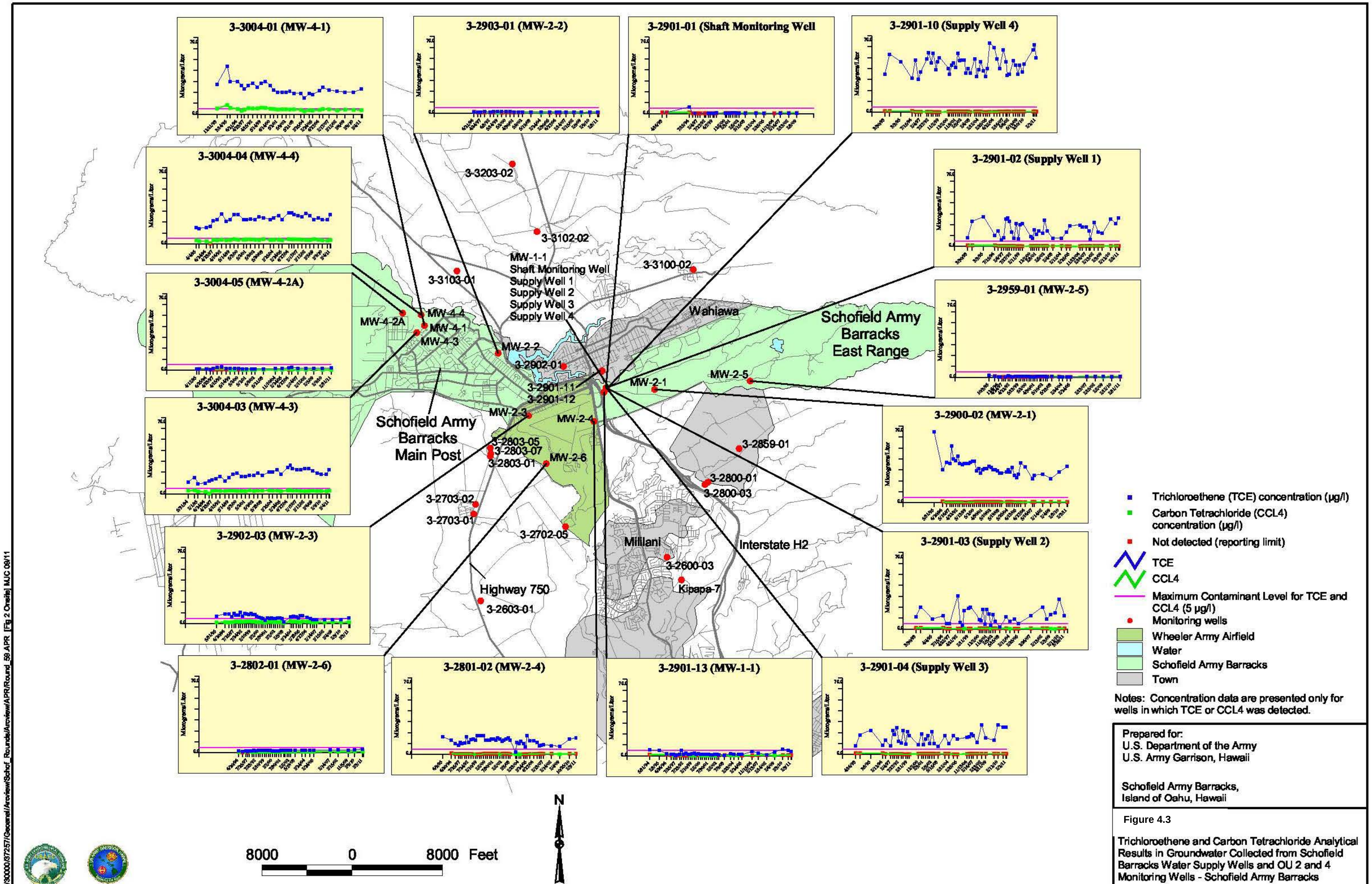


Figure 4.3

Trichloroethene and Carbon Tetrachloride Analytical Results in Groundwater Collected from Schofield Barracks Water Supply Wells and OU 2 and 4 Monitoring Wells - Schofield Army Barracks

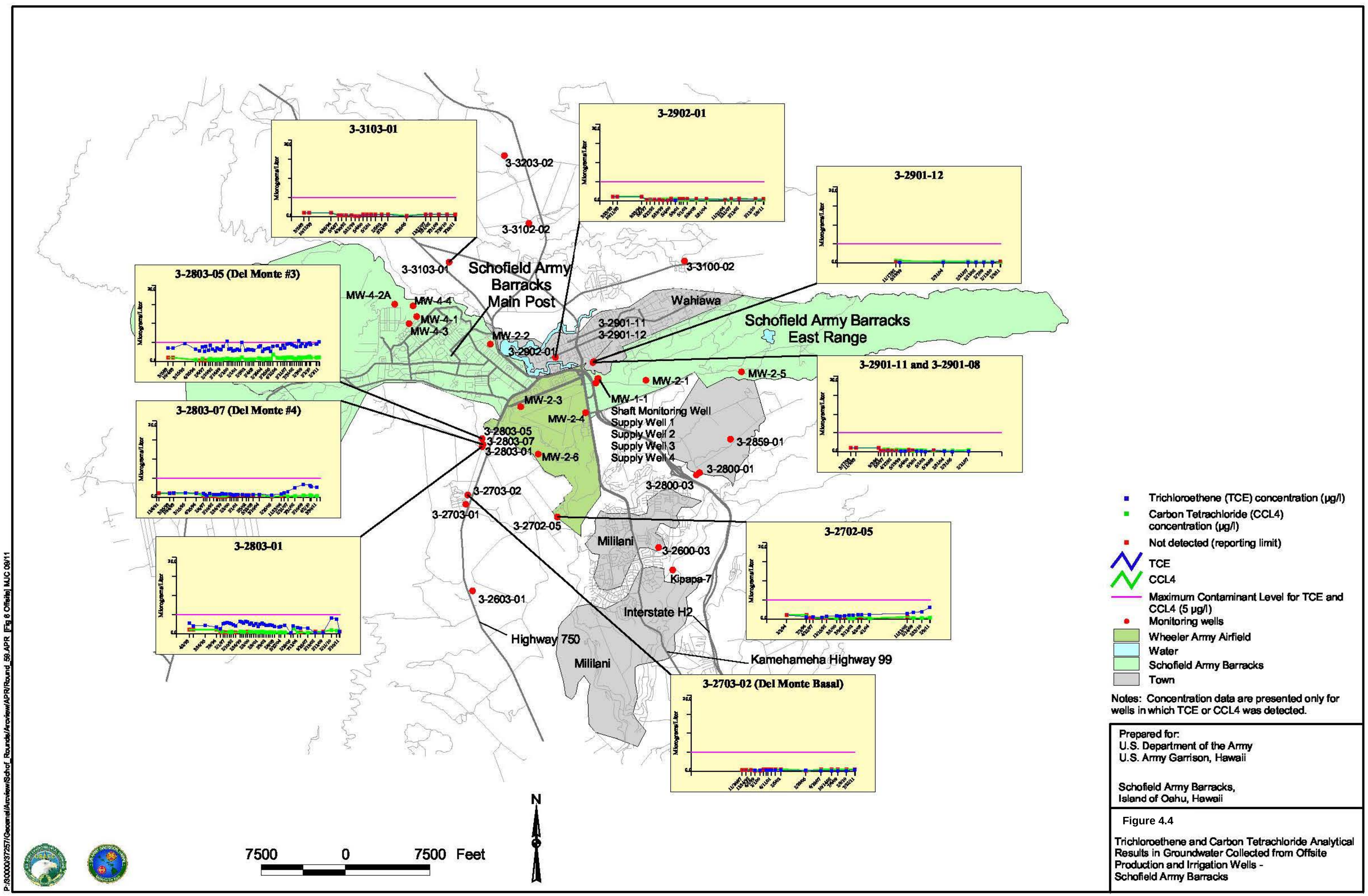
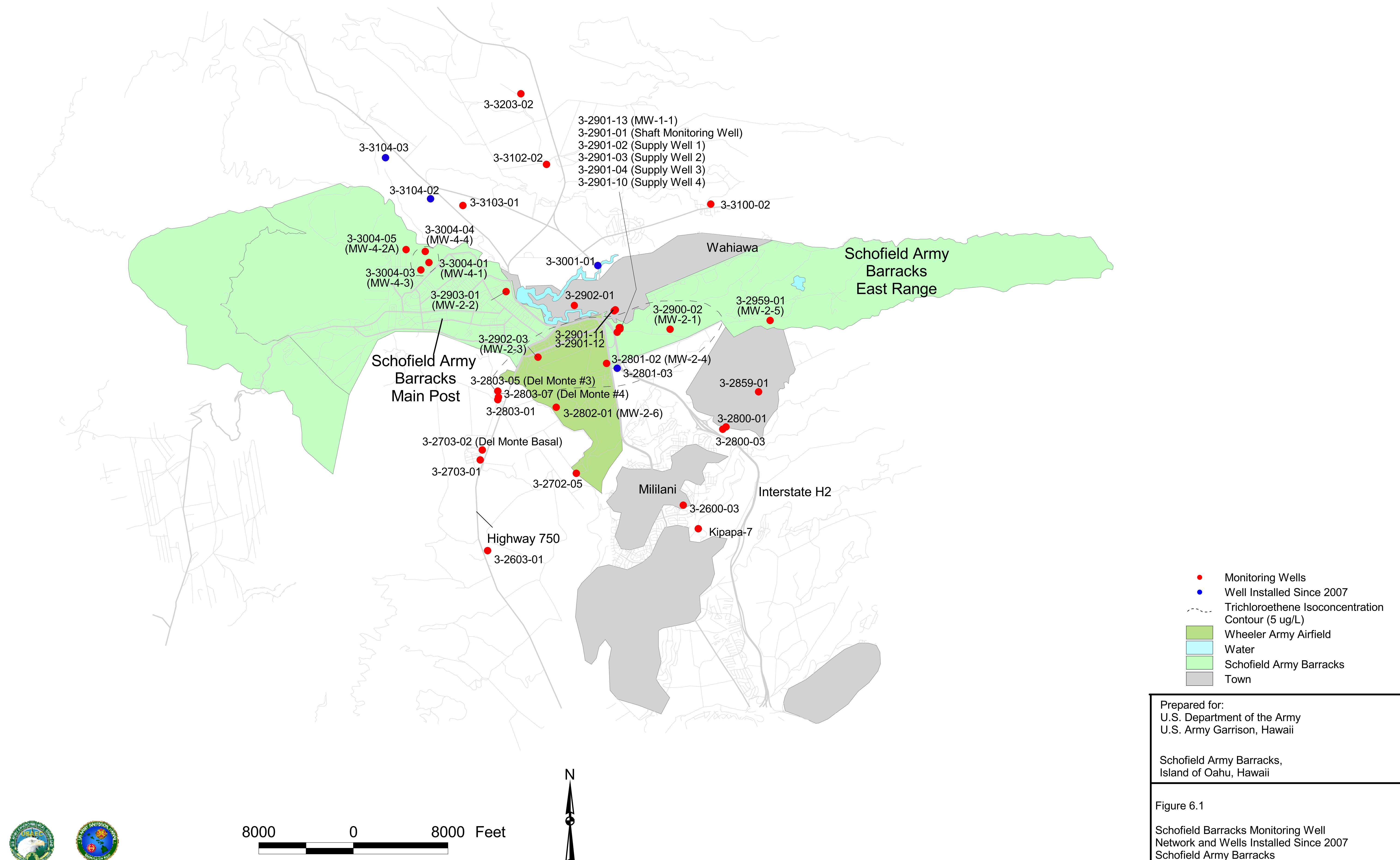


Figure 4.4

Trichloroethene and Carbon Tetrachloride Analytical Results in Groundwater Collected from Offsite Production and Irrigation Wells - Schofield Army Barracks



Prepared for:
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U.S. Army Garrison, Hawaii

Schofield Army Barracks,
Island of Oahu, Hawaii

Figure 6.1

Schofield Barracks Monitoring Well
Network and Wells Installed Since 2007
Schofield Army Barracks

P:/30000/37257/Geoanal/Arcview/Schof_Rounds/Arcview/APR/No_Graphs_0412.APR [Fig 6.1 Onsite] MJC 07/12

Appendix A

OPERABLE UNIT 2
WATER TREATMENT SYSTEM DESCRIPTIONS

Appendix A-1

OPERABLE UNIT 2 SCHOFIELD ARMY BARRACKS
WATER TREATMENT SYSTEM DESCRIPTION

A. SYSTEM DESCRIPTIONS

This section describes the overall treatment plant and its subsystems with respect to design parameters, operations, and maintenance.

The general plant description considers the overall water treatment plant, its major design considerations, and systems.

More detailed descriptions of the component systems follow.

1. GENERAL PLANT DESCRIPTION

The Schofield Barracks Water Treatment Plant (WTP) is designed to remove trichloroethylene (TCE) and minor amounts of tetrachloroethylene (PCE) from the well water by air-stripping (A/S) treatment. Facilities exist to chlorinate the well water before treatment and chlorine and fluoride are added to the water after treatment. A clear well (CW) provides chlorine contact time, and clear-well pumps deliver the treated water to the distribution mains.

Major plant design criteria are as follows:

Design flowrate	8 mgd (5,556 gpm)
Maximum flowrate	10 mgd (6,945 gpm)
Number of A/S towers	Five (one is standby)
TCE removal efficiency with four towers operating at the design flowrate	97.2 percent
Design influent TCE concentration	35 ppb
Calculated effluent TCE concentration	0.98 ppb
Tower height	29 feet (top to be less than H-2 freeway adjacent to the site)
Clear-well capacity	200,000 gallons
Number of CW pumps	Five
Total capacity--CW pumps	10 mgd
CW pump head	210 feet

Deep-Well Pumps

Number installed	Four
Number operational	Three
Number on standby	One
Rated flow/unit	2,000 gpm
Approximate head (as modified for the WTP)	640 feet (277 psi)
Motor horsepower	400 bhp

Chlorination System

150-lb gas cylinders	Two
Feed rate at 10 mgd	42 lb/day
Chlorine residual range	0.2 to 0.5 ppm

The existing chlorine system is retained to chlorinate the well water before A/S treatment.

Fluoridation System

Chemical form	Sodium fluoride
Feed rate at 10 mgd	84 lb/day
Fluoride range	0.6 to 0.8 ppm

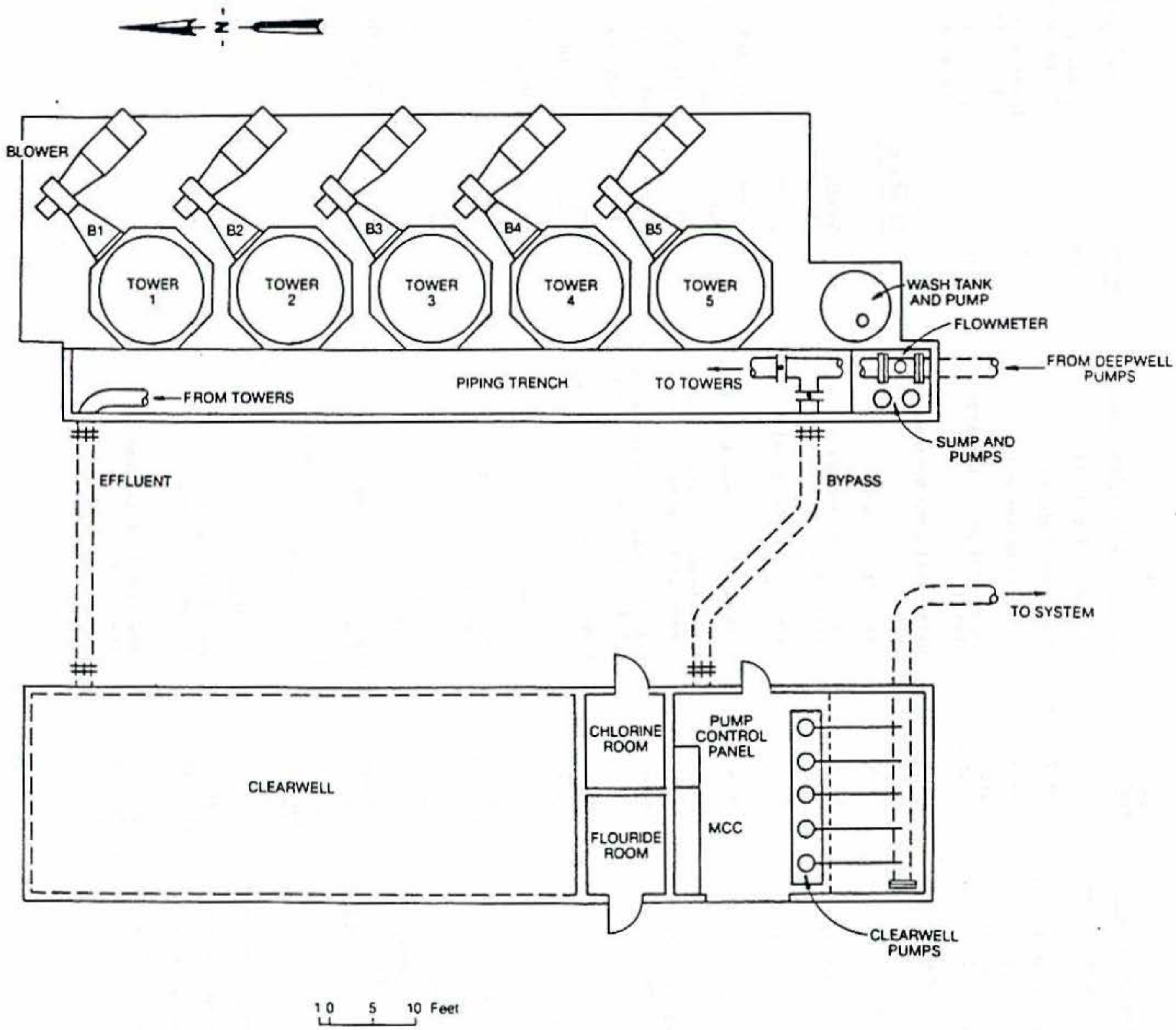
Figure A-1 is a treatment area plan showing the arrangement of major components and Figure A-2 is a plant operations flow diagram identifying pumps, piping, valves, the towers, and other treatment system components. The legend lists the identification and description of the plant components shown in this figure.

2. PLANT SYSTEMS

The treatment plant consists of several major systems as described in this section.

a. Deep-Well Pumps and Header

The four deep-well pumps are located in two underground galleries approximately 565 feet below, and 1,000 feet east of, the treatment site. Access to the deep-well galleries is by a cable-operated railcar through an inclined tunnel with its upper portal in the deep-well house.



SCHOFIELD BARRACKS
WATER TREATMENT PLANT
USERS MANUAL

FIGURE A-1
TREATMENT AREA PLAN

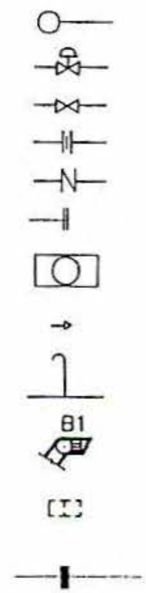
Tag Number	Description/Location
VPD2-1	Deep-well Pump 2 control valve Gallery
VPD2-2	Deep-well Pump 2 shutoff valve Gallery
VPD3-1	Deep-well Pump 3 control valve Gallery
VPD3-2	Deep-well Pump 3 shutoff valve Gallery
VPD4-1	Deep-well Pump 4 control valve Gallery
VPD4-2	Deep-well Pump 3 shutoff valve Gallery
VH	Deep-well header shutoff Wellhouse
VF, VG	Header bypass valves Yard valving area
VE	Deep-well header shutoff Yard valving area
VB	Treatment bypass Pipe trench
VA	Treatment header Pipe trench
V1-1 to V5-1	Tower riser Tower riser piping
V1-2 to V5-2	Tower effluent Tower effluent piping
V1-3 to V5-3	Tower recirculation drain Tower effluent piping
V1-4 to V5-4	Tower recirculation supply Tower riser piping
VRS	Wash tank supply Wash tank
VR-1	Recirculation supply header shutoff Pipe trench--wash tank end
VR-2	Recirculation return header shutoff Pipe trench--wash tank
VR-3	Wash trank drain

Tag Number	Description/Location
VS-1	Sump Pump 1 shutoff
VS-2	Sump Pump 2 shutoff
VID	Influent header drain
VP1-2 to VP5-2	Clear-well pump discharge shutoff
VP1-1 to VP5-1	Clear-well pump bypass control
VX-VY	Future treatment
VC-VD VK-VJ	Distribution shutoff valves Valve yard
VC-I	Inlet header check valve Well house
VC-W	Washdown system check valve
SA-I	Inlet header sample valve Wash tank piping
SA-O	Effluent header sample valve Effluent header-north end
SA-1 through SA-5	Tower 1 through 5 sample valves
	Pumps
PD-1 through PD-4	Deep-well Pumps 1 to 4 Gallery
PW	Wash pump Wash tank
PS1 and PS2	Piping trench sump pumps Sump
PC-1 through PC-5	Clear-well Pumps 1 to 5 CW Buildings
	Other
B1 through B5	Tower 1 through 5 Blowers--blower pad
PT-1 through PT-5	Packed towers 1 through 5 Tower pad

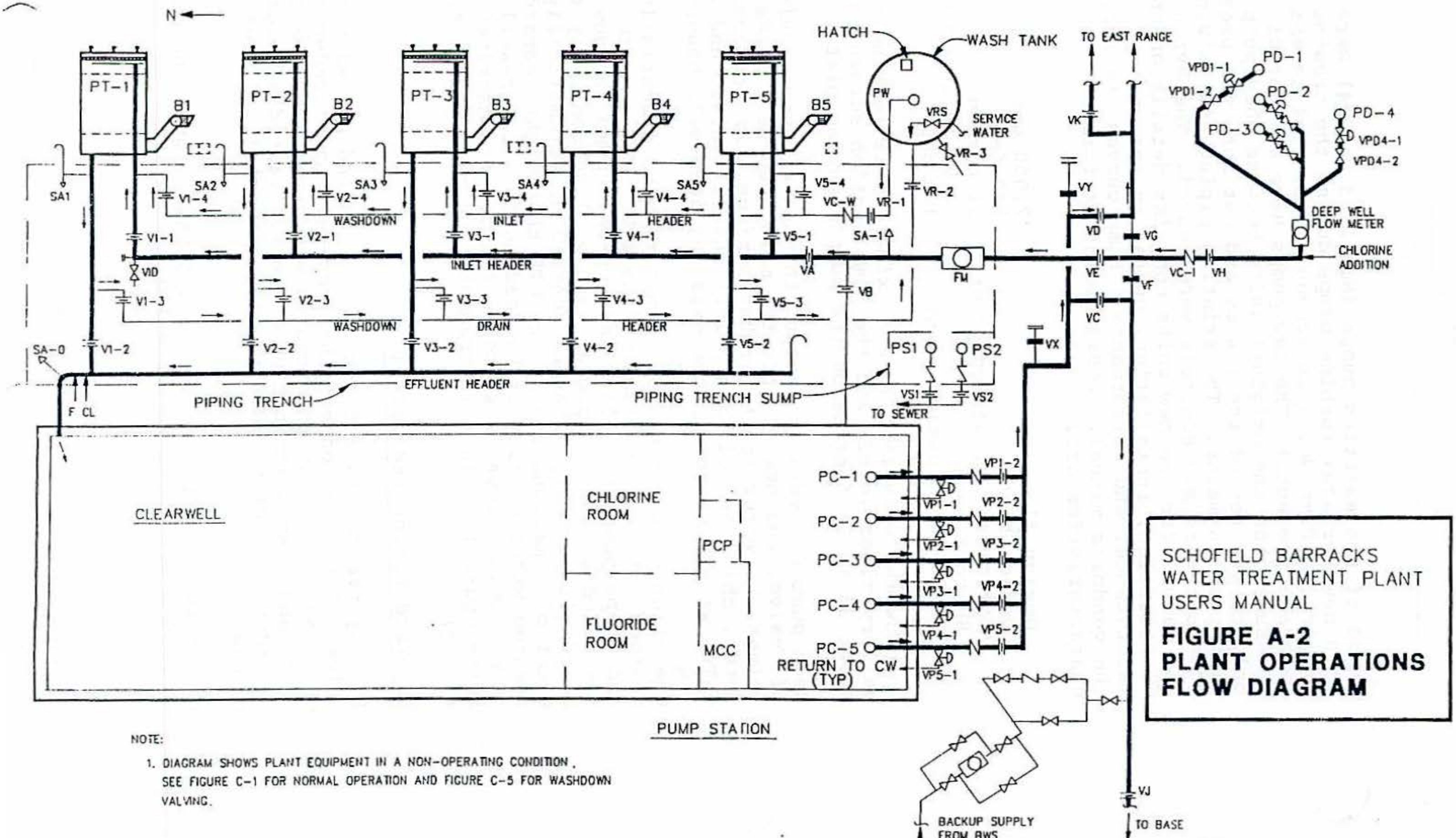
Tag Number	Description/Location
FM	Flowmeter Piping trench--south
F	Fluoride injection Piping trench--north
CL	Chlorine injection Piping trench-north

LEGEND

SYMBOLS



- PUMP
- AUTOMATIC VALVE
- GLOBE OR GATE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- BLIND FLANGE
- FLOW METER
- SAMPLE VALVE
- VENT
- BLOWER AND SILENCER
- RISER, FLOW METER, & BLOWER CONTROL PANELS
- VALVE CLOSED



SCHOFIELD BARRACKS
WATER TREATMENT PLANT
USERS MANUAL

FIGURE A-2
PLANT OPERATIONS FLOW DIAGRAM

NOTE:

1. DIAGRAM SHOWS PLANT EQUIPMENT IN A NON-OPERATING CONDITION. SEE FIGURE C-1 FOR NORMAL OPERATION AND FIGURE C-5 FOR WASHDOWN VALVING.

Three of the existing pumps (No. 2, 3, and 4) were replaced with new vertical turbine pumps during the treatment plant project. (Pump No. 1 is scheduled for replacement on a separate project.) The new pumps have a lower discharge pressure than the original units because they pump water only to the top of the towers and not into the pressurized distribution mains. The existing piping and valving and the 500-hp motors and controls were reused. The Byron Jackson O&M manual for the new units contains details on the pump construction, installation, operation, servicing, maintenance, and performance. Pump curves are included in the vendor's manual. Design point performance characteristics are:

Design flow	2,000 gpm
Design head	640 feet
Efficiency at design point	81 percent
Shutoff head	1,100 feet--approx.
Brake hp at design point	400 bhp

Groundwater elevation is approximately 15 feet below the gallery floor level, and the pump suction screens are at about 33 to 35 feet below the pump mounting plates.

Each pump delivers its output through a control valve, shutoff valve, and header into the main deep-well header that brings the water to the ground surface. An orifice flowmeter, chlorine addition point, shutoff valve, and check valve were retained in the existing deep-well header piping.

Operation of the deep-well pumps remains essentially unchanged with the addition of the WTP. The operator starts and stops pumps manually. A deep-well pump shutdown circuit was added on the WTP project and will sequentially stop deep-well pumps by a manual control or automatically in the event of a malfunction at the WTP that might jeopardize treated water quality or be leading to a clear-well overflow. This automatic shutdown feature is described more fully under the plant instrumentation and control system (A.2.j).

b. Yard Piping and Valving

This system consists of the main line and buried piping and valves that interconnect the deep-well pump header to the treatment plant and the treated water mains to the east range and base distribution headers. Valved stubouts are provided for future additional treatment facilities, if needed.

The valves in the yard system and their functions and normal positions are shown in Table A-1.

During the startup of the WTP and before changeover of the last deep-well pump, this yard valving provided the flexibility to deliver water to the new WTP and distribution system at the same time. With the lower pressure now available at the ground surface, water can be delivered only to the treatment system or directly to the clear well. Pumping into the higher pressure distribution mains is now accomplished by the clear-well pumps.

Table A-1
YARD VALVING

Valve	Function	Normal Operation
V C	Treated water shutoff to base	Open
V D	Treated water shutoff to east range	Open
V E	Deep-well header shutoff	Open
V F	Deep-well header/base cross-connect	Closed
V G	Deep-well header/east range cross-connect	Closed
V H	Deep-well header shutoff	Open
V J	Base shutoff	Open
V K	East range--12-inch shutoff	Open
V X	Future treatment stubout	Closed
V Y	Future treatment stubout	Closed

c. Treatment Piping, Valving, and Fans

This system consists of the tower inlet and outlet headers in the pipe trench; plant flowmeter; the tower riser valve and flowmeter; the tower effluent piping and valve; the washdown piping and valving at each tower; sample taps on the inlet header, outlet header, and outlet of each tower; and the air supply blower to each tower and its controls.

The WTP flowmeter (FM) is a 24-inch in-line Sparling flowmeter with a direct reading integrator and transmitter into instrument and control (I/C) loop 100--plant influent flow (see Section A.2.J, Plant Instrumentation and Controls, for I/C details).

The influent header valve (VA) is used to shut off all flow to the influent header such as when maintenance is required on the influent header or when bypass flow to the clear well is required. VA should remain open at all other times.

The tower riser valves (V1-1 through V5-1) control the flow of well water into the respective towers and are to be adjusted so that approximately equal flows are delivered to each operating tower.

It is important to avoid zero flow on the deep-well pumps by always having a flow path for operating deep-well pumps. For example, the valving sequence for establishing bypass flow to the clear well through VB requires that VB be opened first, then the tower riser valves or header shutoff valve closed to maintain the pump flow during the diversion.

The tower effluent valves (V1-2 through V5-2) are used to isolate the tower from the effluent header during packing washdown. These valves should remain open except when using the packing washdown procedure.

The tower effluent piping includes a P-trap to prevent air loss from the tower air plenum into the discharge header. An overflow is also provided to prevent water from rising into the blower ducting in the event of a higher-than-normal tower water flowrate or restricted effluent flow path. Overflow water is directed to the pipe trench and sump, from which it is pumped to the sewer.

Valves V1-3 through V5-3 and V1-4 through V5-4 are the tower washdown outlet and inlet valves, respectively, to be opened on one tower at a time when that tower is being treated by the washdown system.

Sample valves SA-1 through SA-5 and SA-I and SA-O provide water samples from each tower's output, the well water input, and the combined treated output before the clear well.

Air is supplied to each tower by an individual blower-silencer unit located on the pad, on the east side of the towers. The silencer unit reduces the noise generated by the blower. Each blower unit is designed to the following criteria:

Motor horsepower	10 hp
Air flowrate	11,000 scfm
Total pressure	4-inch water column

- Each blower has a pedestal-mounted safety switch on the south side of the unit used for maintenance lockout purposes and an ON-OFF pushbutton control station located in a pedestal-mounted control box near the pipe trench. These control boxes also house the flowmeters for the tower risers.

Blower pushbutton controls and riser flowmeters for the towers are located on the pedestal-mounted boxes as follows:

Tower	Control Box Location
PT1 and PT2	Between PT1 and PT2
PT3 and PT4	Between PT3 and PT4
PT5	South of PT5

The tower riser valves (V1-1 through V5-1) are used to distribute the well water flow approximately equally to the operating towers as indicated by the riser flowmeters. The riser flowmeters should therefore be calibrated to indicate about the same readings for the same actual flowrate. An adjustment procedure is included in Section C, Operating Instructions.

d. Packed Towers

Five air stripping towers are provided. Each tower shell is constructed of fiberglass reinforced plastic (FRP), 12 feet in diameter and 29 feet in overall height.

The towers and their packing are designed to provide a large area of contact between the well water and the flow of air through the plastic packing. Well water is delivered by the external riser to near the top of the tower and is distributed evenly over the top surface of the packing by a main header and several laterals with multiple orifices. As the water falls by gravity to the base of the tower, it is broken by the packing into many small drops and streams with a large surface area.

Air is forced upward through the packing bed by the blower. The action of the airflow past the large surface area of water removes the volatile TCE and PCE from the water and discharges the contaminants into the atmosphere through the stacks on top of the tower. A low-range pressure switch is actuated by the plenum air pressure and signals the loss of air to the process control computer.

The concentration of PCE in the well water was measured to be below the action level in the early tests. The WTP will remove the PCE with very nearly the same efficiency as for TCE, thereby reducing the resulting PCE to very low levels in the treated water. TCE is therefore considered the primary contaminant of concern in this manual.

At the design conditions of 35-ppb TCE in the well water, an 8-mgd flowrate, and complete stripping, the air emission would contain approximately 2.3 pounds of TCE a day.

The State of Hawaii Department of Health found that "Levels of TCE to be emitted by the stripping towers are within the existing ambient air levels for urban areas in the United States... and no air permits shall be required" (Appendix 1).

The removal efficiency (ratio of volatile compound removed to that in the incoming well water) depends primarily on the packing selection, depth of packing, and the water and air flowrates.

The packing material is Jaeger TriPacks--3-1/2 inches. The packing depth is 17-1/2 feet.

Other design criteria for the A/S system are as follows:

Design system flowrate	8 mgd, four towers
Maximum system flowrate	10 mgd, five towers
Minimum system flowrate	2 mgd
Design water temperature	55°F
TCE removal at design flow	97.2 percent
Hydraulic loading rate/tower	12.4 gpm/sf
Air flowrate/tower	11,000 scfm
Design influent TCE	35 ppb

Figure A-3 shows the design point and estimates of actual removal efficiency per tower over a flow range bracketing the design water flowrate at 11,000-scfm airflow. During startup tests, the well water TCE was measured to be in the range of 29.5 to 47.4 ppb. The treated water TCE concentration was less than 0.5 ppb, the analytical detection limit. This is equivalent to TCE removal efficiencies greater than 98.4 to 98.9 percent over the five towers. A removal efficiency of 98.6 percent is used in this manual to illustrate expected performance. Additional laboratory data on water samples can be used to adjust this estimate as they are obtained.

The maximum individual tower flow should be controlled to be below the rate at which overflow occurs to avoid potential flooding of the fan ducting. This flowrate can be determined by field tests.

The minimum flow to a tower should be controlled to be not less than about 350 gpm. This flowrate represents a

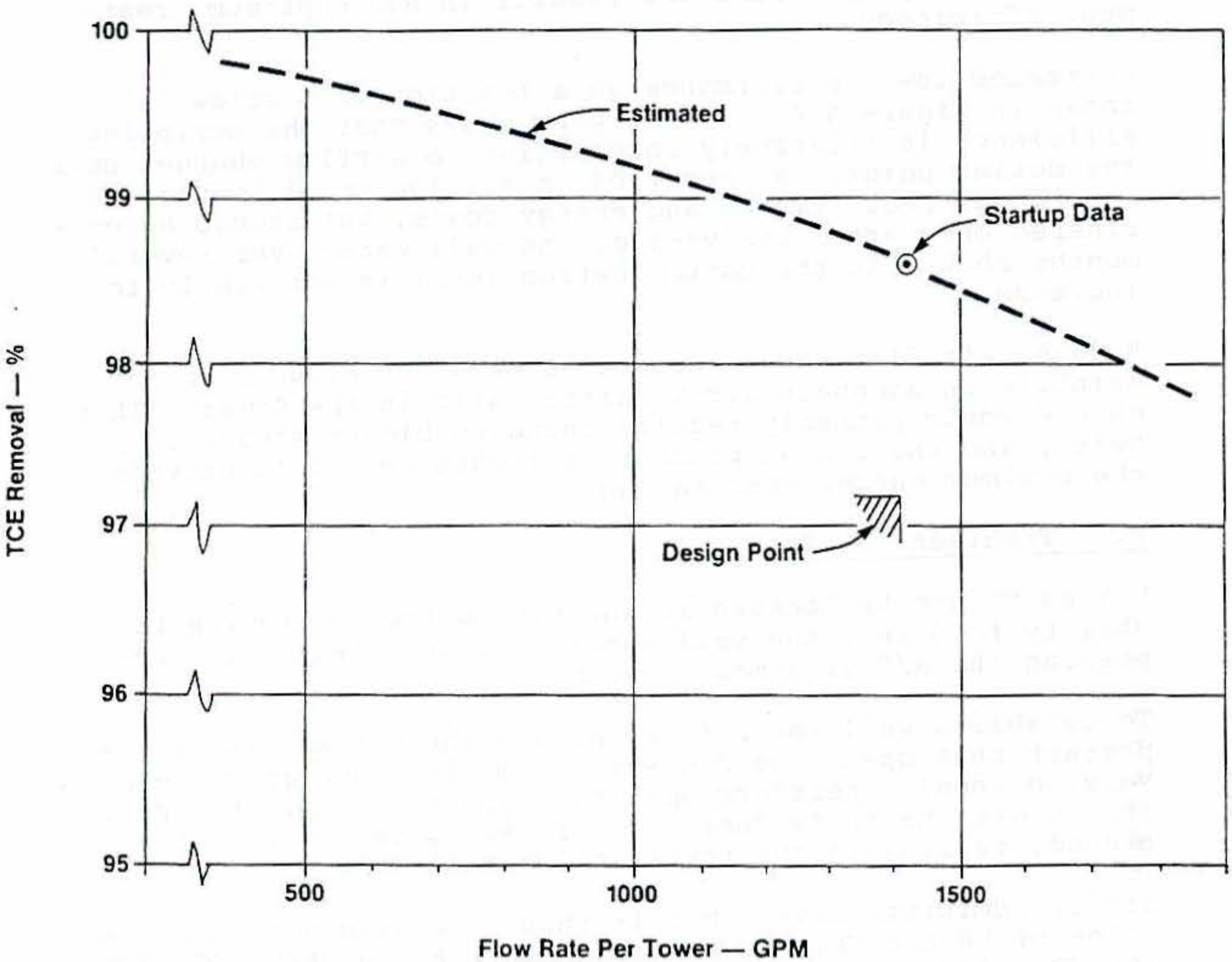


FIGURE A-3
Schofield Barracks WTP
Users Manual
TCE Removal vs Tower Water Flow

reasonably well-balanced flow between five towers operating with one deep-well pump and results in near-optimum treatment efficiency.

Estimated tower performance as a function of airflow is shown in Figure A-4. This figure shows that the stripping efficiency is relatively insensitive to airflow changes near the design point. A reduction in airflow would reduce fan horsepower requirements and energy costs, but should be considered only after analyses of the well water over several months show that the contamination level is not likely to increase.

Reduced air flow should not be below about 6,000 scfm to maintain an adequate air-to-water ratio in the tower. This change would probably require changing blower sheaves, belts, and the plenum pressure switches and would provide the maximum energy cost saving.

e. Treatment Bypass

Valves VB and VA located in the piping trench provide the ability to direct the well water into the clear well, bypassing the A/S treatment system.

To establish well water flow through the bypass, it is important that operating deep-well pump flow not go to zero. Valving should therefore open the bypass valve (VB) first, then close the individual tower riser valves or VA, if needed, to isolate the tower influent header.

Strict administrative controls should be used over the operation of VA and VB. WE RECOMMEND LOCKING VA OPEN AND LOCKING VB CLOSED. Also, a tag should be placed on both VA and VB stating the following:

"1. When valving from treatment operation to bypass operation, OPEN the Bypass Valve VB first and then close the treatment riser valves, V1-1 through V5-1 or VA.

2. When valving from bypass operation to treatment operation, OPEN the treatment riser valves V1-1 through V5-1, the tower effluent valves V1-2 through V5-2 AND VA first, then close the Bypass Valve, VB."

f. Piping Trench and Sump Pumps

The piping trench along the towers houses the A/S system piping and serves to collect washdown water, minor piping leakage, tower overflows, and drainage from the wash tank. The floor of the trench slopes to a sump at its south end where two vertical centrifugal 1.5-hp, 100-gpm sump pumps deliver collected wastewater to a sewer manhole about

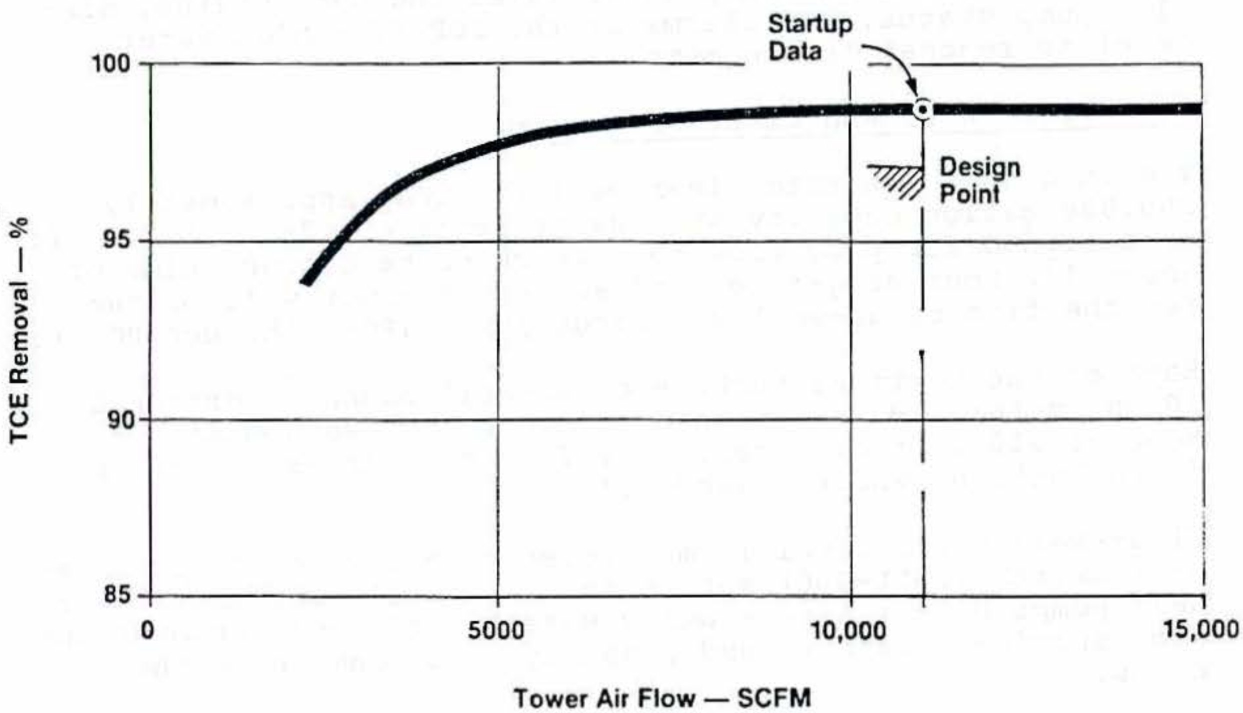


FIGURE A-4
Estimated TCE Removal vs Tower Air Flow

90 feet north of the northern edge of the tower base. The sewer system then conveys the wastewater to a treatment plant on Wheeler AFB.

Controls monitor the sump water level and pump status, display pump status, and alarms at the PCP if a high water level is reached in the sump.

g. Clear Well and Clear-Well Pumps

The in-ground concrete clear well provides approximately 200,000-gallon capacity at a water level of 13-1/3 feet. It is designed for plug flow to give chlorine contact time of about 1/2 hour or greater and serves as a wet well or sump for the five clear-well discharge pumps (PC-1 through PC-5).

Each of the vertical turbine clear-well pumps is driven by a 100-hp motor and is designed to produce 1,400 gpm at a total head of 210 feet of water. (Performance curves are in the Byron Jackson vendor's manual.)

Clear-well water level is monitored by a low-level displacement switch (LSLL-300) set to shut down all operating clear-well pumps before a decreasing water level would uncover the pump suction strainers and possibly cause damage to the pumps.

Clear-well water level is also monitored by a level element and transmitter with an indicator on the PCP and with several set points for CW pump control and level alarms through the PCC.

Figure A-5 shows the set points for pump ON signals as the water level rises and pump OFF signals as the water level falls.

For example, consider that the clear-well pumps are off and are set up properly for automatic operation as controlled by clear-well level, that all deep-well pumps are initially off, and that the clear-well level is below the 8-foot level. A deep-well pump is then started by an operator to meet system demands. It delivers approximately 1,900 gpm to the A/S towers, which flow into the clear well. With no clear-well pumps operating and this inflow rate, the water level will rise at about 1.5 inches per minute (about 8 minutes per foot). When the "on" level for the lead pump is reached (9.25 feet), the lead pump will start and deliver approximately 1,400 gpm from the clear well into the distribution system. (The actual flowrate may vary from this nominal value because of the back pressure in the distribution header.) At a 1,400-gpm outflow rate, the clear-well level will continue to rise at a slower rate with a net inflow rate of about 500 gpm (1,900 - 1,400 = 500 gpm). The time

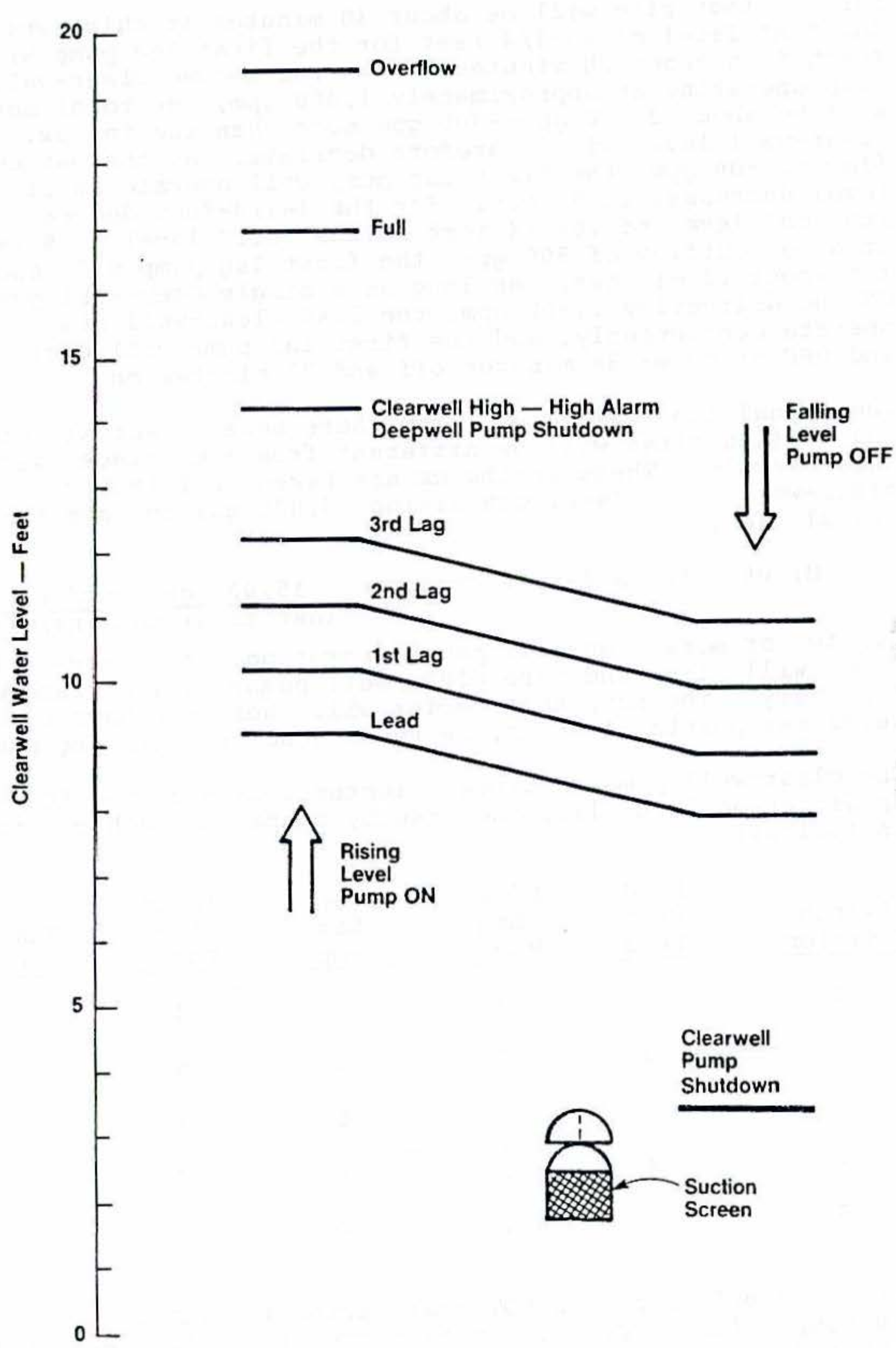


FIGURE A-5
Clearwell Level Set Points

for a 1-foot rise will be about 30 minutes at this rate, and the "on" level of 10-1/4 feet for the first lag pump will be reached in about 30 minutes. With the second clear-well pump operating at approximately 1,400 gpm, the total outflow will be about 2,800 gpm--900 gpm more than the inflow. The clear-well level will therefore decrease. At the net outflow of 900 gpm, the first lag pump will operate until the level decreases to 9 feet. For the 1-1/4-foot decrease from its "on" level of 10-1/4 feet to the "off" level of 9 feet, at a net outflow of 900 gpm, the first lag pump will operate for about 21 minutes. As long as a single deep-well pump is ON and delivering 1,900 gpm, the lead clear-well pump will operate continuously, and the first lag pump will cycle ON and OFF at about 38 minutes off and 21 minutes on.

The actual times will vary from these because actual inflow and outflow rates will be different from the values used in this example. These estimates are based on 1 foot of clear-well water level containing 15,035 gallons and the calculation:

$$\text{Minutes for a 1-foot change} = \frac{15{,}035 \text{ gallons/ft}}{(\text{net flow}) \text{ gallons/min}}$$

For two or more deep-well pumps operating, the clear-well level will rise, and more clear-well pumps will operate continuously. The pump that cycles will therefore have higher level set points--that is, be the second or third lag pump.

The clear-well pump sequence selector switch on the PCP sets up different lead, lag, and standby pumps for each position as follows:

Switch Position	Lead Pump Lead	First Lag Pump	Second Lag Pump	Third Lag Pump	Standby Pump
1	1	2	3	4	5
2	2	3	4	5	1
3	3	4	5	1	2
4	4	5	1	2	3
5	5	1	2	3	4

The "standby" pump does NOT start automatically as a fourth lag pump. Its purpose is to take over for a "failed" unit when that occurs.

The clear-well level instrumentation also provides a clear-well high level alarm on the PCP and a high-high level shutdown signal to the deep-well pumps to avoid an impending clear-well overflow.

In the event, however, that clear-well water does continue to rise above the deep-well pump shutdown level, overflow will occur at a level of about 19-1/2 feet through the four overflow pipes located at the north end of the clear well and may also occur elsewhere, such as around the two hatch covers. Overflow water drains to the runoff collection ditch north of the treatment plant and is conducted to a storm drainage ditch and storm sewer manhole outside the site fence and west of the site entrance road.

Each clear-well pump discharges into the distribution header through a check valve and manually operated shutoff valve. The shutoff valve, which is normally open, provides for maintenance work on the discharge piping of a pump without shutting down the distribution header. The check valve prevents backflow when a pump is not running. A pump bypass control valve (see ClaVal manual) is connected to the side outlet of a tee between the pump discharge and the check valve. Its discharge is directed back to the clear well when the valve is open.

The purpose of the pump bypass control valve is to reduce hydraulic surges on the distribution system when a clear-well pump is started or stopped. The operation of the pump bypass control valve system is controlled by electrical circuitry in each pump's starter section in the MCC and by a limit switch on the bypass valve. Operation may be by either the manual switch on the MCC or by the water level in the clear well. The description that follows assumes that the pump is set up to operate as described by the vendor, clear-well water level is above the low-low shutdown level and power is on to the MCC starter.

The pump-control valve operating cycle in AUTO is as follows:

- With the pump "OFF," the check valve will be closed with distribution system pressure on the header side and atmospheric pressure on the pump side. The pump bypass control valve will be fully open.

- When the clear-well level rises to the ON level, the pump will start through its reduced-voltage and then full-voltage cycles. The initial pump flow will be through the bypass control valve back into the clear well.

- The bypass control valve will then close slowly, gradually increasing the pressure on the pump side of the check valve.

- When the pressure on the pump side of the check valve is slightly greater than the distribution system pressure, the check valve will open--at about zero flowrate, resulting in essentially no surge on the discharge line.

- As the bypass control valve continues to close, flow is established into the distribution header and stopped through the bypass valve.

The operating condition of the pump control valve components is therefore:

Pump	On
Bypass control valve	Closed
Check valve	Open
Flow	To system

This condition continues until an "OFF" signal is received.

- Upon receipt of a pump "OFF" signal, the pump continues to operate, and the bypass control valve begins to open, slowly directing an increasing flow back to the clear well.

- When the flow through the check valve is essentially zero (or very slightly in the reverse direction), the check valve will close, stopping flow to the system and resulting in essentially no surge on the discharge line.

- When the bypass control valve is fully open, its limit switch signals the pump to stop, completing the start-stop cycle and returning the control components to their original condition, ready for the next START signal.

Two alarms are built into this circuitry.

- A pump failure alarm will occur on startup in the event that the pump's "run" contactor is not closed within a preset time delay.

- A valve failure alarm will occur on startup in the event that the bypass valve has not started its travel to close within a preset time period.

When either of these events occurs, the corresponding alarm on the PCP will sound, and the pump will be locked out. The standby pump will be automatically switched into the "failed" pump's position and will start.

h. Chlorine and Fluoride Addition

These systems provide the facilities to feed these chemicals into the treated water before the clear well. The chemical injection ports are on the top of the north end of the A/S effluent header just before it turns to go to the clear well. The chemical feed rooms are on the north side of the clear-well control building.

Chlorine. A gaseous chlorine system is provided with two 150-pound cylinders on scales with an automatic changeover valve. Chlorine feed rate is set on the PCP and is automatically paced with the deep-well pump flow. Chlorine addition is stopped completely when no deep-well pumps are on. A low-chlorine pressure signal will sound an alarm, which is considered a major malfunction because this condition could result in unchlorinated water reaching the distribution system. This condition will sound an alarm on the PCP and the "major" alarm light comes on at the operator's console in the wellhouse.

The chlorine feed room is isolated from other operating areas and is equipped with a chlorine leak detector, motorized damper, and exhaust fans.

The chlorinator vendor's manual contains additional details and safety precautions to guide operations.

The ability to chlorinate well water during "Bypass" operation and to prechlorinate well water before treatment in the towers was retained through the chlorine system adjacent to the operations building.

Fluoride. The fluoride addition system provides the facilities for preparing a saturated fluoride solution from dry, granular sodium fluoride and injecting it into the treated water with a positive displacement feed pump. The dose is set on the PCP, and the solution feed rate is flow paced with plant flow. The feeder is stopped when no deep-well pumps are on.

If the feed pump does not start within a preset time delay after receiving a start signal, an alarm sounds on the PCP, and the "minor" alarm light comes on at the operator's console in the wellhouse.

i. Tower Washdown

This system consists of a 1,900-gallon FRP wash tank, wash pump, controls, water level instrumentation, and piping and valving for draining the tank and connecting it to the recirculation headers in the pipe trench.

The washdown system is provided so that a selected tower packing and internal parts can be shock chlorinated or treated with an acid solution when needed to control undesirable growths or deposits.

For chlorine treatment, the tower to be treated is shut down and isolated from the influent and effluent headers. The wash tank is filled with service water. Household bleach is then added to give a chlorine solution of 80 to 100 ppm. The system valving is lined out to recirculate the wash tank solution through the tower when the wash pump is started. Approximately 500 gpm will recirculate through the system as long as the pump is on. The solution will drain back to the wash tank when the pump is stopped. The wash tank is then drained to the sump and the chlorine solution pumped to the sewer. The tank is refilled and the tower rinsed down with clean water and drained to the wash tank, and the rinse, drain, pump-out cycle is repeated until the chlorine residual in the tower effluent is considered suitable for valving into the clear well (for example, a residual of 0.5 ppm or less).

The time interval between chlorine washdown treatments, the duration of the chlorine recirculation and the chlorine residual considered suitable for a return to normal service, can be determined only by trial including monitoring chlorine residuals and analyzing tower effluent for bacteria count.

Given the quality of the well water, mineral deposits on the packing are not considered likely. The materials of construction of the washdown system are designed for a mild hydrochloric acid (5 percent), however, so that an acid washdown could be performed, if needed. Note that disposal of a waste acid solution may require neutralization such as by the addition of soda ash in the wash tank or sump before pumping to the sewer.

j. Plant Instrumentation and Controls (I/C)

The WTP instrumentation and control system consists of a number of operator controls and process sensing devices located throughout the plant, a process control computer (PCC) located in the pump control panel (PCP) enclosure in the clear-well pump building, and status lights located on the operator's panel in the wellhouse.

This section of the manual describes the function and location of the I/C components used by a plant operator.

Details of the I/C design and PCC programming are contained in the plant drawings, specifications, and vendor's manual.

The plant I/C functions are identified as "loops" and are shown schematically on the process and instrumentation diagram of Figure A-6. The panel layout and parts identification for the PCP and tower controls are shown in Figure A-7.

In the following loop descriptions, the instrumentation device identification symbols, as shown on the process and instrumentation diagram (Figure A6) are referenced in parentheses.

See also Volume 6--Instruments and Controls for additional details of the I/C system.

<u>100 Loop--Plant Flow</u>. The WTP flowmeter (FT100) is located at the south end of the pipe trench in the influent header. It has a flow register that shows the total volume of water delivered to the treatment plant. The flowrate is transmitted to the recorder (FIR100) on the PCP in the clear-well pump building and is also used to flow-pace the chlorine and fluoride addition systems.

<u>200 Series Loops--Tower Blower Controls</u>. A blower safety switch is pedestal mounted just south of each blower unit (B1 through B5). This switch is used to isolate the motor from the electrical supply for maintenance purposes and must be in the ON position for the blower to operate.

The blower ON-OFF controls are pushbuttons (HS211 through HS215) mounted on the pedestal-mounted panels located near the pipe trench, as follows:

Tower 1	between tower 1 and 2--north side
Tower 2	between tower 1 and 2--south side
Tower 3	between tower 3 and 4--north side
Tower 4	between tower 3 and 4--south side
Tower 5	south of tower 5

When a blower is "ON," an indicator light (QL211 through QL215) on the PCP comes on.

A blower failure is sensed by a pressure switch (PSL211 through PSL215) connected to the tower air plenum. In normal operation this pressure will be slightly above atmospheric pressure to force the airflow through the packing and out of the tower. If the airflow stops for any reason, the plenum pressure decreases to atmospheric and the switch signals the control system to sound the fan failure annunciator (QA211 through QA215) (light the "major" alarm light on the operator's console) and to shut down the operating deep-well pumps in sequence. This shutdown action is taken

INSTRUMENT IDENTIFICATION

1. Instrumentation devices are shown on the Diagram (Figure A-6) by a circle with a number in the lower half and letters in the upper half.

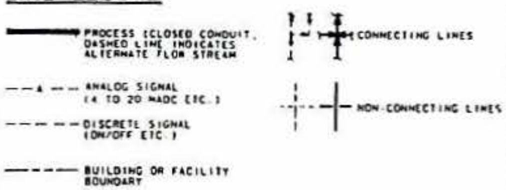
2. The numbers refer to the instrument "Loop". The Loops are described in the text and are summarized as follows:

Loop	Function
100	Plant Flow
200	Tower Blower Controls
300	Clear Well Level and Pump Controls
400	Chlorine System
500	Fluoride System
600	Tower Washdown System
700	Pipe Trench Sump Pumps
800	Annunciators and Plant Alarms
900	Deep Well Pump Shutdown

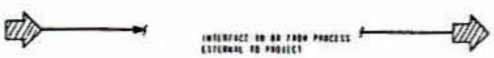
3. The letters describe the process variable and function of the device. Letter symbols and their meaning are as follows:

Loop	Function
OA	Indicator Alarm Light
OL	Indicator Light
HS	Hand Switch
LAH	Level Alarm — High
LSH	Level Switch — High
LAL	Level Alarm — Low
LSL	Level Switch — Low
LAHH	Level Alarm — High High
LSHH	Level Switch — High High
LSM	Level Switch — Medium
FT	Flow Transmitter
FQI	Flow Integrator Indicator
FIR	Flow Indicator Recorder
FI	Flow Indicator
PSL	Pressure Switch — Low
LI	Level Indicator
LSLL	Level Switch — Low Low
LALL	Level Alarm — Low Low
LT	Level Transmitter
LE	Level Element
PI	Pressure Indicator
ZS	Position Switch
FCV	Flow Control Valve
FSL	Flow Switch — Low
FFC	Flow Pacing Control
PAL	Pressure Alarm — Low
AAH	Air Alarm — High (Chlorine)
AE	Air Sensor — (Chlorine)
FV	Flow Valve
SC	Speed Controller
PI	Pressure Indicator

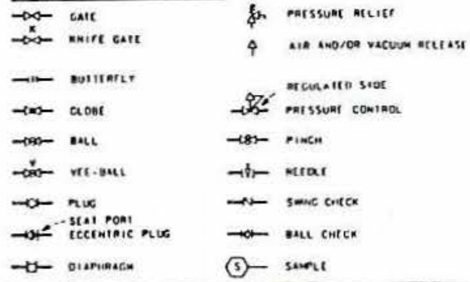
LINE LEGEND



INTERFACE SYMBOLS

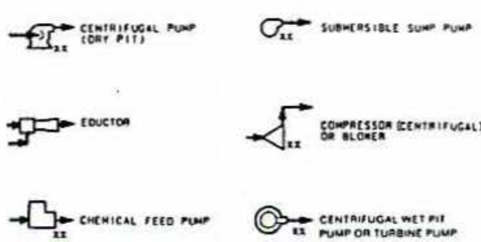


VALVE SYMBOLS



PRIMARY ELEMENT SYMBOLS

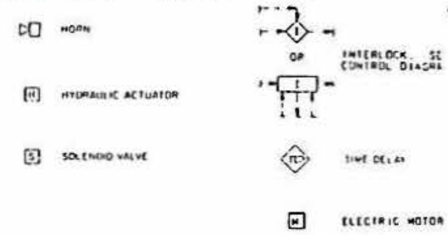
PUMP & COMPRESSOR SYMBOLS



ABBREVIATIONS & LETTER SYMBOLS

AC	ALTERNATING CURRENT
AM	AUTO-MANUAL
Cl_2 etc.	CHLORINE (TYPICAL: USE STANDARD CHEMICAL ELEMENT ABBREVATION)
CP	CONTROL PANEL
DC	DIRECT PANEL
LR	LOCAL-REMOTE
MA	MANUAL-AUTO
MCC	MOTOR CONTROL CENTER
OO	ON-OFF
OOA	ON-OFF-AUTO

MISCELLANEOUS SYMBOLS



SCHOFIELD BARRACKS WTP
USERS MANUAL

PROCESS AND INSTRUMENTATION DIAGRAM
LEGEND

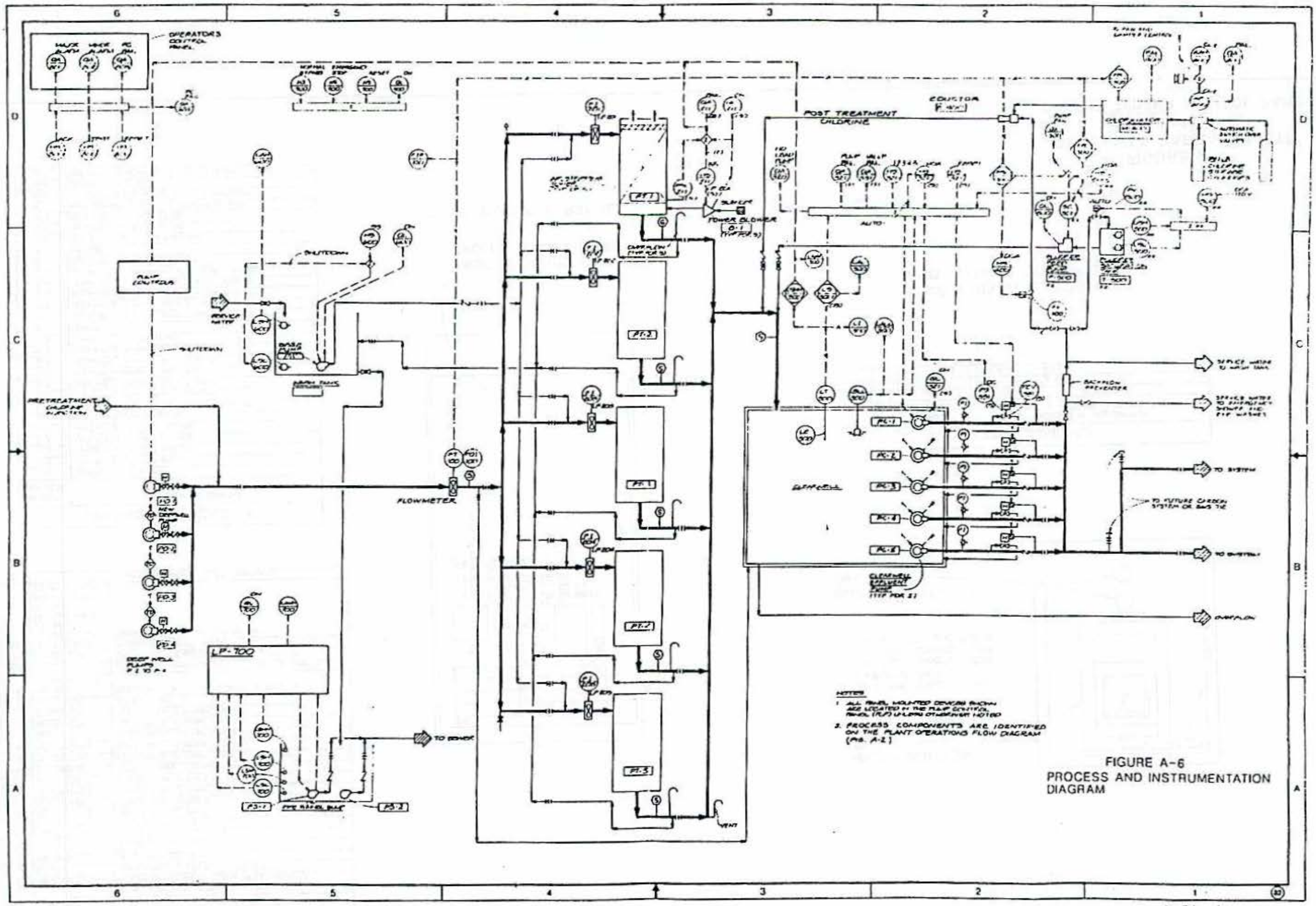
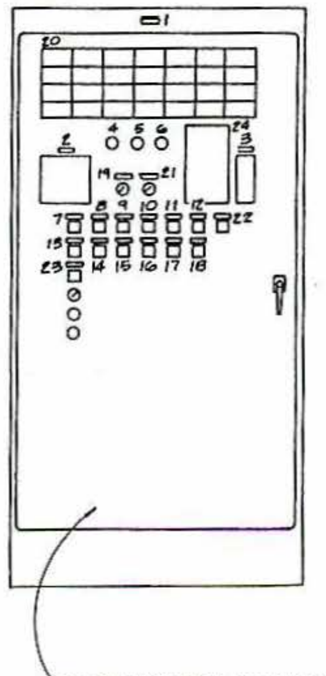


FIGURE A-6
PROCESS AND INSTRUMENTATION DIAGRAM

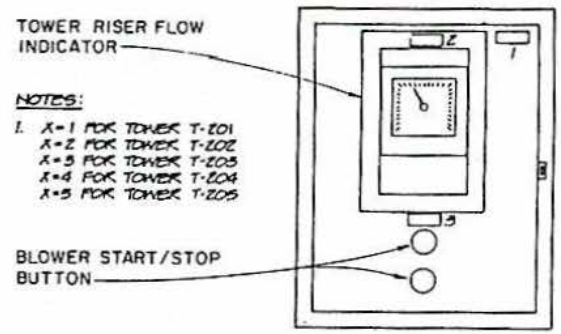
PANEL SCHEDULE		
ITEM NO.	TAG NO.	NAMEPLATE INSCRIPTION
1		PUMP CONTROL / PANEL (PCP)
2	FIR-100	PLANT INFLUENT / FLOW (RECORDER)
3	LI-300	CLEARWELL / LEVEL (INDICATOR)
4	HS-800	ACKNOWLEDGE
5	HS-800	TEST
6	HS-800	RESET
7	QL-211[ON]	TOWER FAN / NO.1
8	QL-212[ON]	TOWER FAN / NO.2
9	QL-213[ON]	TOWER FAN / NO.3
10	QL-214[ON]	TOWER FAN / NO.4
11	QL-215[ON]	TOWER FAN / NO.5
12	QL-700[ON]	PIPE TUNNEL / SUMP PUMP
13	QL-321[ON]	CLEARWELL / PUMP NO.1
14	QL-322[ON]	CLEARWELL / PUMP NO.2
15	QL-323[ON]	CLEARWELL / PUMP NO.3
16	QL-324[ON]	CLEARWELL / PUMP NO.4
17	QL-325[ON]	CLEARWELL / PUMP NO.5
18	QL-600[ON]	WASH PUMP
19	HS-320 [1-2-3-4-5]	CLEARWELL PUMP / SEQUENCE SELECT
20		(28 POINT ANNUNCIATOR - LIGHT CABINET)
21	HS-400[OCA]	CHLORINE / EJECTOR SUPPLY / VALVE
22	QL-500[ON]	FLUORIDE / FEED PUMP
23	QL-900 [ON] HS-800 [NORMAL-BYP] HS-900 [EMERG STOP] HS-900 [RESET]	DEEP WELL / PUMP SHUTDOWN
24		(TIMER/COUNTER ACCESS MODULE)

ANNUNCIATOR SCHEDULE	
WINDOW ROW-COL	WINDOW INSCRIPTION
1-1	TOWER FAN / NO.1 FAILURE
1-2	TOWER FAN / NO.2 FAILURE
1-3	TOWER FAN / NO.3 FAILURE
1-4	TOWER FAN / NO.4 FAILURE
1-5	TOWER FAN / NO.5 FAILURE
1-6	CLEARWELL / HIGH LEVEL
1-7	PROGRAMMABLE CONTROLLER FAILURE
2-1	CLEARWELL PUMP / NO.1 FAILURE
2-2	CLEARWELL PUMP / NO.2 FAILURE
2-3	CLEARWELL PUMP / NO.3 FAILURE
2-4	CLEARWELL PUMP / NO.4 FAILURE
2-5	CLEARWELL PUMP / NO.5 FAILURE
2-6	CLEARWELL / LOW LEVEL
2-7	(BLANK)
3-1	CLEARWELL / PUMP NO.1 / VALVE FAILURE
3-2	CLEARWELL / PUMP NO.2 / VALVE FAILURE
3-3	CLEARWELL / PUMP NO.3 / VALVE FAILURE
3-4	CLEARWELL / PUMP NO.4 / VALVE FAILURE
3-5	CLEARWELL / PUMP NO.5 / VALVE FAILURE
3-6	CLEARWELL / LOW-LOW LEVEL
3-7	(BLANK)
4-1	CHLORINATOR / LOW PRESSURE
4-2	FLUORIDE PUMP / FAILURE
4-3	WASH TANK / HIGH LEVEL
4-4	PIPE TUNNEL / SUMP / HIGH-HIGH LEVEL
4-5	NO LEAD / CLEARWELL PUMP / SELECTED
4-6	CHLORINE / LEAK
4-7	CHLORINE / LEAK DETECTOR / FAILURE



PROCESS CONTROL COMPUTER
(PCC) IS INSIDE ENCLOSURE

PUMP CONTROL PANEL



PANEL SCHEDULE		
ITEM NO.	TAG NO.	NAMEPLATE INSCRIPTION FIRST LINE / SECOND LINE / THIRD LINE
1		LP-20(X)
2	FI-20(X)	TOWER NO.(X) / INFLUENT FLOW
3	HS-21(X)(SS)	TOWER FAN / NO.(X)

TOWER RISER FLOWMETER
AND BLOWER CONTROL PANEL

FIGURE A-7
SCHOFIELD BARRACKS WTP
USERS MANUAL
PCP AND TOWER CONTOL PANEL

to limit the delivery of untreated well water into the distribution system.

300 Series Loops--Clear-Well Level and Pump Controls. Two separate level sensors are used on the clear-well water level. They are located in the clear well behind the fluoride addition room.

One sensor provides the signal for the clear-well pump controls, the level indicator on the PCP (LI300), and the high level alarms (LAHH300). The transmitter (LT300) for this sensor displays the water level in percent of full scale (16 feet).

The other level sensor (LSLL300) is a switch separate from the PCP, used to shut down any operating clear-well pumps at its low level set point and thereby protect the pumps from possible damage if they were to run dry or cavitate.

The operation of the clear-well pumps under automatic control by the level signal is described under Section A.2.g, Clear Well and Clear-Well Pumps.

The pump control HAND-OFF-AUTO switches (HS321 through HS325) are located on the MCC. The sequence selector switch ON indicator lights (QL321 through QL325) and valve and pump failure annunciators (QA331 through QA335 and QA321 through QA325) are on the PCP.

400 Series Loops--Chlorine System. The chlorine system instrumentation is located in the chlorine room and provides for flow pacing (FFC400); a low-chlorine pressure switch (PAL400), which signals an annunciator on the PCP and shuts down the deep-well pumps; and chlorine leak detection (AAH400), which sounds an annunciator on the PCP (QA400), sounds a warning horn, and actuates exhaust blowers and a motor-operated damper on the north wall of the chlorine room.

A chlorine eductor control switch (HS400) (OPEN-CLOSE-AUTOMATIC) is located on the PCP and controls the solenoid valve (FV400) supplying service water to the chlorine eductor. The chlorine solution is delivered to the injection point on the treated water header at the north end of the pipe trench. In the AUTOMATIC position, the solenoid valve closes when plant flow is less than 1,000 gpm (no deep-well pumps on). Details of the chlorine equipment are in the vendors' manuals.

500 Series Loops--Fluoride System. The fluoride system plant instrumentation and controls provide for flow-paced (FFC500) injection of a fluoride solution, a feed pump control switch (HS500) on the PCP, and a pump failure

annunciator (QA500) on the PCP. Instruments and controls supplied with the vendor's equipment provide for automatic fluoride solution preparation and feed pump control. Refer to the Wallace and Tierman manuals for details.

600 Series Loops--Tower Washdown System. The I/C components for this system consist of the wash tank level switches (LSL600 and LSH600), which signal a high level on a PCP annunciator and a low level shutdown of the wash pump (PW). The pump ON-OFF control station is at the pump, and an indicator light (QL600) is lit on the PCP when the pump is running. The approximate flowrate being pumped is indicated by the tower riser flowmeter (FI201 through FI205) on the tower being treated.

700 Series Loop--Pipe Trench Sump Pumps. Level switches (LSL700, LSM700, LSH700 and LSHH700) in the sump at the south end of the pipe trench are designed to control the operation of the two sump pumps (PS-1 and PS-2) through a local control unit (LP700). An annunciator on the PCP sounds in the event of a high-high level in the sump, and an indicator light (QL700) on the PCP shows that a sump pump is running.

800 Series Loops--Annunciators and Plant Alarms (Figure A-7). Individual annunciators are described under the plant systems. The annunciator panel controls are located on the PCP and consist of TEST, RESET, and ACKNOWLEDGE pushbutton switches (HS800).

The TEST switch illuminates all of the visual indicators when it is pushed.

When a plant function exceeds its annunciator set point, the corresponding annunciator panel light flashes on and off and the alarm horn sounds. By pushing the ACKNOWLEDGE pushbutton, the horn is silenced, and the lighted panel changes to STEADY-ON. After the plant function returns to its normal range, pushing the RESET pushbutton will turn off the panel light. Operating the RESET button will not turn the light off if the alarm condition still exists.

Plant alarm conditions are classified into three groups as follows:

Major Alarms

- Tower Blower Failure--loss of tower airflow and therefore a loss of treatment on the affected tower
- Clear-Well High-High Level--impending overflow
- No Clear-Well Pump Selected--clear-well pumps not properly set to pump out of the clear well; impending overflow

Chlorine Leak--low or lost chlorine addition to treated water

Chlorinator Low Pressure--loss of chlorine addition to treated water

Occurrence of any of these alarms lights the major alarm indicator light on the operator's panel in the deep-well house and requires immediate attention.

PCC Failure Alarm

PCC failure is detected by the loss of a normally continuously energized output. This condition will shut down the entire deep-well and treatment system,is annunciated on the PCP, and lights the PCC failure alarm light at the operator's panel in the deep-well house.

Minor Alarms

All other annunciated conditions on the PCP are considered to be minor alarms and light the minor alarm light on the operator's panel in the deep-well house. These conditions require operator attention, but not necessarily as quickly as for the major and PCC failure alarms.

900 Series Loops--Deep-Well Pump Shutdown. The deep-well pump (PD-1 through PD-4) shutdown interlock is controlled through the NORMAL/BYPASS keylock selector switch (HS900) on the PCP. In the NORMAL mode, the programmable controller will initiate the deep-well pump shutdown. In the BYPASS mode, the programmable controller's automatic shutdown control is bypassed, allowing only manual shutdown of the deep-well pumps at the PCP or at existing manual control stations.

The BYPASS feature was included in the plant at the request of the operators to provide flexibility of operations and avoid a deep-well pump shutdown at their discretion.

Bypassing this feature could result in delivering untreated water to the distribution system or overflowing the clear well. Bypass operation should therefore be under strict administrative controls and the switch returned to NORMAL after any required BYPASS operation.

The interlock has an adjustable time delay so that the pump shutdowns are staggered. The adjustable time delay period is zero to 2 minutes for each pump. Once shut down, the deep-well pumps are not allowed to restart until the condition that initiated the shutdown is corrected. A light on the PCP (QL900) indicates deep-well pump shutdown.

When in the NORMAL mode, the deep-well pump shutdown interlock is initiated on any of the following conditions:

(1) Tower blower failure: If, under running conditions, a tower blower (TSF211 through TSF215) fails, the programmable controller will shut down the operating deep-well pumps through the deep-well pump shutdown interlock. When water flow through the system stops (FSL100), the programmable controller will close the chlorine dilution water valve (FV400), shut down the chlorinator (M400), and stop the fluoride feed pump (P500). The clear-well booster pumps (PC-1 through PC-5) continue to operate until the level in the clear well reaches the programmed clear-well pump shutdown levels. All other blowers in operation at the time of the failure continue to operate until they are manually stopped. The blower failure cannot be reset until the STOP pushbutton of the failed unit has been depressed.

A tower blower (B1 through B5) must be operating to cause a system shutdown on failure. If a blower fails when it is called to start, it will not activate the system shutdown interlock.

(2) Controller failure: If the programmable controller fails, the existing deep-well pumps (PD-1 through PD-4) will shut down through the deep-well pump shutdown interlock. The rest of the system will shut down automatically because of the failure of the programmable controller.

(3) No clear-well booster pump (PC-1 through PC-5) selected: If the programmable controller senses that there is no clear-well booster pump selected, the following sequences occur:

(a) If the system is not in operation, the programmable controller will inhibit the existing deep-well pumps from starting through the deep-well pump shutdown interlock until the condition is corrected.

(b) If the system is in operation, the programmable controller will shut down the existing deep-well pumps through the deep-well pump shutdown interlock. When water flow through the system stops, the programmable controller will shut down the rest of the system as described in the tower blower failure condition with the exception that the clear-well booster pumps are shut down and locked out by the PC until the failure condition is corrected and the RESET pushbutton on the PCP has been depressed.

(4) Clear-well high-high level: If a clear-well high-high level (LSHH300) is detected (after an adjustable time delay), the programmable controller will shut down the existing deep-well pumps through the deep-well pump shutdown interlock. When water flow through the system stops, the programmable controller will shut down the rest of the system as described in the tower blower failure condition.

(5) No tower blowers on: If the programmable controller senses that there are no tower blowers (B1 through B5) running, the programmable controller will inhibit the deep-well pumps through the deep-well pump shutdown interlock.

(6) Manual emergency shutdown: The EMERGENCY STOP mushroom head pushbutton (HS900) on the PCP will initiate a deep-well pump shutdown when depressed. The manual shutdown operates in both NORMAL and BYPASS deep-well pump shutdown modes. When initiated, the deep-well pumps will be shut down through the deep-well pump shutdown interlock. Once the deep-well pump shutdown interlock has been initiated, the programmable controller will shut down the rest of the system as described in the tower blower failure condition. The deep-well pumps will not be allowed to restart until the emergency shutdown RESET pushbutton (HS900) has been depressed.

Timer Counter Access Module. The timer counter access module allows the operator to monitor the status of all counters and timers in the PCC program. The unit also allows the operator to change the preset values for timers and counters.

Along with timers and counters the unit provides the operator the ability to monitor and change PCC register values.

k. Electrical System

Electrical power for the WTP is supplied by a primary 7,200-volt, three-phase overhead line at the plant substation and is delivered through underground conduit to the 750-kVA, 7,200-480/277V pad-mounted transformer east of the clear-well pump building. The secondary of the transformer is connected to the main breaker and metering section (A) of the MCC in the clear-well pump building (refer to vendor's data in Section 4). Voltage, current, demand, and kWh meters are mounted on the metering panel (refer to Volume 4--Electrical for vendor's data and to plant as-built drawings).

MCC Sections B, C, D, E, and F house the electrical controls for the tower blowers and clear-well pumps; blower No. 1 and clear-well pump No. 1 starters are in Section B, blower No. 2 and clear-well pump starters in Section C, etc. Reduced voltage starters and power factor correcting capacitors are used on the clear-well pump circuits. The clear-well pump HAND-OFF-AUTO selector switch, RESET pushbutton, and ON indicator light are on the face of the MCC panel.

The control relays for the pump bypass control valve circuits are inside each starter enclosure.

Sections G and H of the MCC house the starters for the wash pump and vent fans, the circuit breaker feeding the sump pump control panel, and the service transformer and circuit breaker panel.

1. Corrosion Protection System

The corrosion protection system is designed to protect the buried fabricated steel clear-well discharge header from potentially destructive corrosion. The system consists of three vertical graphite anodes spaced along the header's length and buried beside the clear-well building's north sidewalk. The anodes are connected together, and the common anode lead conductor is connected to the cathodic protection rectifier mounted on the inside wall of the pump station. The rectifier connection to the header pipe is made at a flanged pipe connection on the discharge piping of one of the clear-well pumps.

In operation, the rectifier impresses a direct current on the anode-header system, which protects the header.

A test station is also provided in the design with lead wires connected on both sides of the flexible pipe coupling joining the steel header and ductile iron pipe. These leads terminate on a terminal block in a flush housing located in the asphalt paving near the southwest corner of the clear-well building. The test station will be used by a corrosion specialist to obtain electrical data on the buried piping, which is needed to adjust the rectifier properly.

Other than maintaining power to the rectifier and routinely recording its output, there are no operating or maintenance requirements for the WTP staff. An experienced corrosion control specialist with highly specialized test equipment should adjust the system initially and check its performance periodically. A contracted service is suggested.

Appendix A-2

DOCUMENTATION OF SANDWICH ISLES COMMUNICATION AIR STRIPPER
(Full Documents Included on Enclosed Compact Disc)

Appendix B

LIST OF DOCUMENTS REVIEWED FOR FIVE-YEAR REVIEW PROCESS

APPENDIX B

List of Documents Reviewed—Operable Units 2 and 4
(Listed chronologically)

Operable Unit 2 Documents

Final Record of Decision for Operable Unit 2, Schofield Army Barracks, Island of Oahu, Hawaii. August 12, 1996. Harding Lawson Associates.

Final Operation and Maintenance and Long-Term Groundwater Monitoring Plan for Operable Unit 2, Schofield Army Barracks, Island of Oahu, Hawaii. September 13, 1996. Harding Lawson Associates.

Correspondence: Draft Request for Change in Use Classification of Well 3-2803-01, Schofield Army Barracks, Island of Oahu, Hawaii, Unknown date, 2002. DPW.

Technical Memorandum for Record: Addendum to the OU2 O&M Plan, Revision 5 PBC for Schofield and TAMC, Schofield Barracks, Island of Oahu, Hawaii, April 10, 2006. Versar.

Design Documentation Report, Final Design Submittal, Design & Installation of an Air Stripping
System, Sandwich Isles Communication Field Site, Waipio Acres, Oahu, Hawaii. November 2010. Greenwave.

Air Stripping System Design, Sandwich Isles Communication Field Site, Waipio Acres, Oahu, Hawaii. Record Drawings As-Built. Contract W9128A-10-P-0024. January 25, 2012. Greenwave.

Air Stripping System Design - SIC Field Site, AirSS, Final Specifications.

State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. Obtained 2012. Water Use Permit for Wells 3001-01, 3104-01, 3104-02, and 3104-03.

Operable Unit 4 Documents

Final Record of Decision for Operable Unit 4, Schofield Army Barracks, Island of Oahu, Hawaii. July 12, 1996. Harding Lawson Associates.

Final Operation and Maintenance and Long-Term Groundwater Monitoring Plan for Operable Unit 4, Schofield Army Barracks, Island of Oahu, Hawaii. September 13, 1996. Harding Lawson Associates.

Technical Memorandum for Record: Side Slope Maintenance Schofield Barracks Landfill, Schofield Barracks, Island of Oahu, Hawaii, January 25, 2006. Schofield Barracks DPW.

Technical Memorandum for Record: Addendum to the OU4 O&M Plan, Revision 5 PBC for Schofield and TAMC, Schofield Barracks, Island of Oahu, Hawaii, April 10, 2006. Versar.

Annual Report, Del Monte Air Stripper, Oahu, Hawaii. April 2008. ECC.
Final 2008 Annual Report, Del Monte Air Stripper, Oahu, Hawaii. March 2009. ECC.

Final Annual Report, January – December 2009, Kunia Village Air Stripper, Oahu, Hawaii. January 2010. ECC.

Final Annual Report, January – December 2010 Kunia Village Air Stripper, Oahu, Hawaii. February 2011. ECC.

Draft Letter Report, Central Drainage Channel Repair, Operable Unit 04, Schofield Barracks, Oahu, Hawaii, December 2010. ECC.

Review Comments from USAG-HI and Responses, Letter Report, Central Drainage Channel Repair Operable Unit 04, Schofield Barracks, Oahu, Hawaii.

Review Comments from U.S. Army Corps of Engineers and Responses, Letter Report, Central Drainage Channel Repair Operable Unit 04, Schofield Barracks, Oahu, Hawaii.

U.S. Army Corps of Engineers Quality Assurance Review of Central Drainage Channel Repair, Operable Unit 04, Schofield Barracks, Oahu, Hawaii. U.S. Army Corps of Engineers, Environmental Technical Branch. January 18, 2012.

Documents for Operable Units 2 and 4

Final Community Relations Plan for Schofield Army Barracks, Island of Oahu, Hawaii. January 1997. Harding Lawson Associates.

Comprehensive Five-Year Review Guidance, June 2001. EPA.

Correspondence: Re: Groundwater Monitoring Sampling Frequency, Schofield Army Barracks, Island of Oahu, Hawaii, November 4, 2002. DPW.

Correspondence: Re: Army Request to Modify Groundwater Sampling Schedule, Schofield Army Barracks, Island of Oahu, Hawaii, August 24, 2005. EPA.

Correspondence: Review of the First Final Annual Long-Term Groundwater Monitoring Report for Operable Units 2 and 4, calendar year, Schofield Army Barracks, Island of Oahu, Hawaii, June 29, 2006. Hawaii DOH.

Correspondence: Review of the Addendum to the OU2 and OU4 Operation and Maintenance Plan, Schofield Army Barracks, Island of Oahu, Hawaii, July 6, 2006. Hawaii DOH.

Correspondence: Re: Groundwater Monitoring Sampling Frequency, Schofield Army Barracks, Island of Oahu, Hawaii, July 17, 2006. EPA.

Correspondence: Review of the Third Final Long-Term Groundwater Monitoring Report for Operable Units 2 and 4, August 2005, Schofield Army Barracks, Island of Oahu, Hawaii, January 19, 2007. Hawaii DOH.

Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, February 2007. May 2, 2007. ECC and MACTEC.

Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, May 2007. July 25, 2007. ECC and MACTEC.

Comments Regarding Long-Term Monitoring Report Operable Units 2 and 4 Schofield Army Barracks (ECC and MACTEC, May 2007), Oahu, Hawaii. Hawaii DOH. August 24, 2007.

Response to Request for Concurrence – Proposal to Change Reporting Frequency for Long-term Groundwater Monitoring, Schofield Barracks Operable Unit-2 and Operable Unit-4, Oahu, Hawaii. Hawaii DOH. January 18, 2008.

Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, June to September 2007. March 31, 2008. ECC and MACTEC.

Long-Term Groundwater Monitoring Report, Operable Unit 4, Schofield Army Barracks, Oahu, Hawaii, December 2007. March 31, 2008. ECC and MACTEC.

Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, February 2008. June 3, 2008. ECC and MACTEC.

Long-Term Groundwater Monitoring Report, Operable Unit 4, Schofield Army Barracks, Oahu, Hawaii, May 2008. June 20, 2008. ECC and MACTEC.

Affidavits of Public Notice for Solicitation of Interest in Forming Restoration Advisory Boards. Dated August 12, 2008 (two affidavits this date); April 13, 2010 (two affidavits this date); July 26, 2011.

Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, May to August, 2008. October 28, 2008. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Unit 4, Schofield Army Barracks, Oahu, Hawaii, November 2008. January 7, 2009. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, October 2008 to February 2009. April 13, 2009. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Unit 4, Schofield Army Barracks, Oahu, Hawaii, May 2009. June 24, 2009. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, May to August February 2009. November 4, 2009. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Unit 4, Schofield Army Barracks, Oahu, Hawaii, First Quarter Report FY10, November and December 2009. April 15, 2010. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, Semiannual Report FY10, November 2009 to February 2010. April 13, 2010. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Unit 4, Schofield Army Barracks, Oahu, Hawaii, Third Quarter Report FY10, March through June 2010. June 25, 2010. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, Annual Report FY10, June to September 2010. November 10, 2010. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, Semiannual Report FY11, October 2010 to March 2011. July 26, 2011. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, Third Quarter Report FY11, March to May 2011. July 26, 2011. ECC and MACTEC.

Final Long-Term Groundwater Monitoring Report, Operable Units 2 and 4, Schofield Army Barracks, Oahu, Hawaii, Annual Report FY11, October 2010 to September 2011. 17 November 2011. ECC and AMEC.

Appendix C

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Table C.1: Location-specific Applicable or Relevant and Appropriate Requirements for Operable Unit 2 at Schofield Barracks

Location Characteristic(s)	Prerequisite(s)	Requirement(s)	Citation(s)
Wilderness areas, wildlife resources, wildlife refuges, or scenic rivers			
· Within area affecting stream or river **-and** - presence of fish or wildlife resources	· Presence of fish or wildlife resources; action by federal agency that results in the control or structural modification of a natural stream or body of water · Offsite response action	· The effects of water-related projects on fish and wildlife resources must be considered. · Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. · Offsite actions that alter a resource require consultation with the FWS, NMFS, and/or the appropriate state agency. · Consultation with the responsible agency is also strongly recommended for onsite actions.	· Fish and Wildlife Coordination Act (16 USC 661 *et seq.*), §§662 and 663 – **applicable** · 40 CFR §6.302(g) (applies to federal agencies only) **- TBC**
· Location encompassing aquatic ecosystem with dependent fish, wildlife, other aquatic life, or habitat	· Action(s) involving the discharge of dredge or fill material into aquatic ecosystem	· Degradation or destruction of aquatic ecosystems must be avoided to the extent possible. Discharges that cause or contribute to significant degradation of the water of such ecosystems are prohibited.	· Clean Water Act §404 - **applicable** · 40 CFR §230 **– applicable** · 33 CFR §320-330 - **applicable**
· Presence of wild birds or their nests		· The intentional, knowing, or reckless taking, catching, injuring, killing, destroying, or keeping in captivity or possession of wild birds is prohibited. · Damaging or destroying the nests of wild birds is prohibited.	· HRS §183D-61 *et seq.* **– applicable**

Table C.1 (continued)

Location Characteristic(s)	Prerequisite(s)	Requirement(s)	Citation(s)
Endangered, threatened, or rare species			
· Presence of endangered or threatened species or critical habitat (see above citation) of same within an aquatic ecosystem as defined in 40 CFR §230.3(c)	· Action involving discharge of dredge or fill material into aquatic ecosystem	· Dredge or fill material shall not be discharged into an aquatic ecosystem if it would jeopardize such species or would likely result in the destruction or adverse modification of a critical habitat of the species.	· Clean Water Act §404 – **applicable** · 40 CFR §230.10(b) – **applicable**
· Presence of federal or state endangered or threatened species		· The taking of any threatened or endangered species within the state is prohibited.	· HRS §195D-4 – **applicable**
· Presence of endangered or threatened species **-or-** critical habitat of such species as designated in 50 CFR §17, 50 CFR §226	· Action that is likely to jeopardize species or destroy or adversely modify critical habitat	· Actions that jeopardize species/habitat must be avoided or appropriate mitigation measures taken. · Offsite actions that affect species/habitat require consultation with DOI, FWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. · Consultation with the responsible agency is also strongly recommended for onsite actions.	· Endangered Species Act of 1973 (16 USC 1531 *et seq.*) - **applicable** · 50 CFR §402 - **applicable** · 40 CFR §6.302(h) - **TBC** · Fish and Wildlife Coordination Act (16 USC 661 *et seq.*) - **applicable**

Source: United States Army Environmental Center

CFR Code of Federal Regulations
DOI Department of Interior
FWS U.S. Fish and Wildlife Service
HAR Hawaii Administrative Rule
HRS Hawaii Revised Statutes
NMFS National Marine Fisheries Service
TBC To be considered
USC United States Code

Table C.2: Chemical-specific Applicable or Relevant and Appropriate Requirements and "To-Be-Considered" Guidance for Cleanup of Groundwater at Schofield Barracks Operable Unit 2[a]

Chemical	Relevant and Appropriate Requirements[b]			TBC Guidance[c]
	SDWA MCLs[d] (µg/l)	Hawaii MCLs[e] (µg/l)	SDWA MCLGs[f] (µg/l)	Health Advisories[g] (µg/l)
Acetone	5 <u>NA</u>	NA	NA	NA
Benzene	***5***	5	0	1[h] <u>NA</u>
bis(2-Ethylhexyl)phthalate	***6***	NA	0	3[h]
2-Butanone (methyl ethyl ketone)	NA	NA	NA	i <u>***4,000***</u>
Carbon disulfide	NA	NA	NA	NA
Carbon tetrachloride	***5***	5	0	0.3[h] <u>NA</u>
Chloromethane	NA	NA	NA	NA
1,1-Dichloroethane	NA	NA	NA	NA
1,2-Dichloroethane	***5***	5	0	0.4[h] <u>NA</u>
cis-1,2-Dichloroethene	***70***	70	0 <u>70</u>	NA <u>70</u>
trans-1,2-Dichloroethene	***100***	100	0 <u>100</u>	NA <u>100</u>
Ethylbenzene	700	700	***700***	700
2-Hexanone	NA	NA	NA	NA
4-Methyl-1-pentanone	NA	NA	NA	NA
4-Methyl-2-pentanone	NA	NA	NA	NA
Methylene chloride	***5***	NA	0	5[h] <u>NA</u>
Nitrobenzene	NA	NA	NA	NA
Phenol	NA	NA	NA	4,000 <u>***20***</u>
Pyrene	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA
Tetrachloroethene	***5***	5	0	0.7[h] <u>10[h]</u>
Toluene	1,000	1,000	***1,000***	1,000<u>[i]</u>
Trichloroethene	***5***	5	0	3[h]<u>[i]</u>
Vinyl chloride	***2***	2	0	NA
Xylenes, total	10,000	10,000	***10,000***	10,000 <u>NA</u>

Source: United States Army Environmental Command

<u>Underlined</u> Indicates values changed since the Final Record of Decision for Operable Unit 2, Harding Lawson Associates, August, 1996. Updated value is underlined.

ARARs Applicable or relevant and appropriate requirements
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CFR Code of Federal Regulations
EPA U.S. Environmental Protection Agency
HA Health advisory
MCL Maximum contaminant level
MCLG Maximum contaminant level goal
NA Not Applicable
µg/l Micrograms per liter
SDWA Safe Drinking Water Act
TBC To be considered
USAEC U.S. Army Environmental Command

a. This table provides ARARs or TBC guidance for all chemicals detected in the groundwater at Schofield Barracks, as reported in Table 3.5 of the Draft Final Sampling and Analysis Plan for Operable Unit 4 Phase II Remedial Investigation and Feasibility Study Field Program, August 19, 1994. The bolded and italicized values indicate the ARAR or TBC for each chemical. The MCLs/MCLGs in this table are relevant and appropriate requirements for cleanup of extracted groundwater. The MCLs would be applicable "at the tap." These decisions are based on the determination that the underground water system at Schofield Army Barracks is a public water system designated as a Community Water System by the Hawaii Department of Health, Division of Drinking Water (Personal communication with A. Zane, Engineer, Division of Drinking Water, July 25, 1995). A Community Water System is "a public water system which serves at least 15 connections used by year-round residents or regularly serves at least 25 year-round residents." (40 CFR § 141.2 Definitions [1994] and Hawaii Administrative Rules 20 § 11-20-2 Definitions [1994]).

b. Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site." (40 CFR § 300.5 Definitions. [1994]). "Maximum contaminant level goals (MCLGs), established under the Safe Drinking Water Act, that are set at levels above zero, shall be attained by remedial actions for ground waters that are current or potential sources of drinking water, where the MCLGs are relevant and appropriate under the circumstances of release." (40 CFR § 300.430[e][2][i][B] [1994]).

c. This "category consists of advisories, criteria, or guidance that were developed by the EPA, other federal agencies, or states that may be useful in developing CERCLA remedies." (40 CFR § 300.400[g][3] [1994]). TBCs are nonpromulgated advisories and are not legally binding. They "do not have the status of potential ARARs." (CERCLA Compliance with Other Laws Manual Draft Guidance, USEPA OSWER Directive 9234.1-01, 1988.)

d. 40 CFR Part 141 Subpart B and Subpart G (1994).

e. State of Hawaii Maximum Contamination Levels. Rules Relating to Potable Water Systems Title 11 Chapter 20 §§ 11-20-2, -3, and -4, as amended, originally effective August 8, 1977, as Chapter 49 of the Public Health Regulations, Department of Health.

f. 40 CFR Part 141 Subpart F (1994).

g. USEPA Office of Water Lifetime Health Advisories (HAs) for a 70-kg Adult, August 2006.

h. USEPA Office of Water Health Advisory representing a 1×10^{-6} cancer risk, the concentration in drinking water that will result in one excess cancer death in one million people , August 2006.

i. Under review. Drinking Water Regulations and Health Advisories, USEPA Office of Water, August 2006. The 2012 non-cancer screening level for TCE is 2.6 μg/l (2012 Edition of the Drinking Water Standards and Health Advisories, EPA 822-S-12-001, April 2012).

Table C.3: Action-specific Applicable or Relevant and Appropriate Requirements for Operable Unit 2 at Schofield Army Barracks, Hawaii

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation
Alternative 1 No Action				
Institutional controls	Institutional controls such as water use and deed restrictions to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants.	Presence of hazardous substances, pollutants, or contaminants.	40 CFR § 300.430(a)(1)(iii)(D) **to be considered**.	
Alternative 2 Air Stripping				
Fugitive dust emissions	Visible fugitive dust emissions must not be discharged beyond the property lot line on which the fugitive dust originates. Reasonable precautions must be used to prevent fugitive dust emissions.	Fugitive emissions from excavation of contaminated soil and construction of pads.		Title 11-60.1-33(a)(1) through (7) and (b) **applicable**
Air emissions from the air stripper	Administrative and substantive requirements of permit if exemption listed at §11-60.1-62(d)(1) cannot be met. Requirements include the installation of devices for the measurement or analysis of source emissions or ambient concentrations of air pollutants; monitoring; and requirements concerning the use, maintenance, and installation of monitoring equipment.	Exemption under HAR 11-60.1-62(d)(1) cannot be met.		Title 11-60.1-68 **applicable**
Discharge of treated groundwater	Comply with MCLs. See Section 3 of the OU 2 FS Report for a discussion of MCLs.	Discharge of treated groundwater into water distribution system.		

Table C.3 (continued)

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation
Alternative 4 Peroxide/Ozone Oxidation				
Fugitive dust emissions	See Alternative 2			
Discharge of treated groundwater	See Alternative 2			

CFR Code of Federal Regulations
HAR Hawaii Administrative Rule
MCL Maximum contaminant level
RCRA Resource Conservation and Recovery Act
UV Ultraviolet

Table C.4: Location-specific Applicable or Relevant and Appropriate Requirements for Operable Unit 4 at Schofield Army Barracks, Hawaii

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	Citation(s)
Wilderness areas, wildlife resources, wildlife refuges, or scenic rivers			
• Within area affecting stream or river **-and** - presence of fish or wildlife resources	• Action that results in the control or structural modification of a natural stream or body of water	• The effects of water-related projects on fish and wildlife resources must be considered. • Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. • Offsite actions that alter a resource require consultation with the FWS, NMFS, and/or the appropriate state agency. • Consultation with the responsible agency is also strongly recommended for onsite actions.	• Fish and Wildlife Coordination Act (16 USC 661 et seq.) - **applicable** • 40 CFR 6.302(g) (applies to federal agencies only) - **TBC**
• Location encompassing aquatic ecosystem with dependent fish, wildlife, other aquatic life, or habitat	• Action(s) involving the discharge of dredge or fill material into aquatic ecosystem	• Degradation or destruction of aquatic ecosystems must be avoided to the extent possible. Discharges that cause or contribute to significant degradation of the water of such ecosystem are prohibited.	• Clean Water Act §404 - **applicable** • 40 CFR 230 - **applicable** • 33 CFR 320-330 - **applicable**
• Presence of wild birds or their nests		• The intentional, knowing, or reckless taking, catching, injuring, killing, destroying, or keeping in captivity or possession of wild birds is prohibited. • Damaging or destroying the nests of wild birds is prohibited.	• *HRS,* §183D-61 et seq. - **applicable**
Endangered, threatened, or rare species			
• Presence of endangered or threatened species or critical habitat (see above citation) of same within an aquatic ecosystem as defined in 40 CFR § 230.3(c)	• Action involving discharge of dredge or fill material into aquatic ecosystem	• Dredge or fill material shall not be discharged into an aquatic ecosystem if it would jeopardize such species or would likely result in the destruction or adverse modification of a critical habitat of the species.	• Clean Water Act §404- **applicable** • 40 CFR 230.10(b) - **applicable**
Endangered, threatened, or rare species (continued)			
• Presence of federal or state endangered or threatened species		• The taking of any threatened or endangered species within the state is prohibited.	• *HRS* §195D-4- **applicable**

Location Characteristic(s)	Operating Condition(s)	Requirement(s)	Citation(s)
• Presence of endangered or threatened species –or- critical habitat of such species as designated in 50 CFR 17 or 50 CFR 226	• Action that is likely to jeopardize species or destroy or adversely modify critical habitat	• Actions that jeopardize species/habitat must be avoided or appropriate mitigation measures taken. • Offsite actions that affect species/habitat require consultation with DOI, FWS, NMFS, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. • Consultation with the responsible agency is also strongly recommended for onsite actions.	• Endangered Species Act of 1973 (16 USC 1531 et seq.) - **applicable** • 50 CFR 402 - **applicable** • 40 CFR 6.302(h) - **TBC** • Fish and Wildlife Coordination Act (16 USC 661 et seq.) - **applicable**

CFR Code of Federal Regulations
DOI Department of Interior
FWS U. S. Fish and Wildlife Service
HAR Hawaii Administrative Rule
HRS Hawaii Revised Statutes
NMFS National Marine Fisheries Service
USC United States Code

Table C.5: Action-specific Applicable or Relevant and Appropriate Requirements for Operable Unit 4 at Schofield Army Barracks, Hawaii

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation(s)
Fugitive Dust Emissions	Visible fugitive dust emissions must not be discharged beyond the property lot line on which the fugitive dust originates. Reasonable precautions must be used to prevent fugitive dust emissions.	Fugitive emissions from excavation of contaminated soil and construction of pads		§11-60.1-33(a)(1) through (7) and (b) **applicable**
Surface-Water Control	NPDES permit required for offsite discharges and discharges to a POTW. NPDES permit is not required for onsite discharges, but the substantive requirements of the permit must be complied with for onsite discharges, offsite discharges, and discharges to a POTW.	Storm-water runoff associated with construction activity, including clearing, grading and excavation, except operations that result in the disturbance of less than five acres of total land area, which are not part of a larger common plan of development or sale.		§*11-55-34.02, (b) (2) Appendix C* **applicable**
	Monitoring required to ensure compliance with applicable state water quality standards.	Storm-water runoff from construction activity		§*11-55-34.04 (b), Appendix A* **applicable**
Institutional Controls	Following closure of all municipal solid waste landfill (MSWLF) units, the owner or operator must record a notation on the deed to the landfill facility property, or some other instrument that is normally examined during title search, and notify the Director of Health that the notation has been recorded and a copy has been placed in the operating record.			§11-58.1-17(a)(9)(A) **relevant and appropriate**
	The notation on the deed must in perpetuity notify any potential purchaser of the property that the land has been used as a landfill facility and its use is restricted under § 11-58.1-17(b)(3)(C) of the Hawaii Administrative Rules.			§11-58.1-17(a)(9)(B) **relevant and appropriate**
Long-term Groundwater Monitoring and Maintenance of the Landfill Cover	Groundwater monitoring must be conducted throughout the postclosure care period for the MSWLF unit, unless a demonstration is made showing that a reduced period is sufficient to protect human health and the environment and this demonstration is approved by the Director [11-58.1-17(b)(2)(A)]74	A MSWLF unit		§11-58.1-16(a)(5) **relevant and appropriate**

Table C.5 (continued)

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation(s)
	A groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that represent the quality of background water that has not been affected by leakage from the unit and the quality of groundwater passing the relevant point of compliance specified by the Director of Health.			§11-58.1-16(b)(1) **relevant and appropriate**
	Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole.			§11-58.1-16(b)(3) **relevant and appropriate**
	Owner or operator must establish background groundwater quality in a hydraulically upgradient or background well(s) for each monitoring parameters or constituents required in the particular groundwater monitoring that applies to the MSWLF unit, as determined under § 11-58.1-16(d)(1) or (e)(1).			§11-58.1-16(c)(5) **relevant and appropriate**
	Detection monitoring must be performed. The minimum of detection monitoring allowed is for the constituents listed in Appendix I to 40 CFR Part 258. If there is a statistically significant increase over background for one or more of the constituents listed in Appendix I to 40 CFR Part 258 at any monitoring well at the boundary, then an assessment monitoring program must be established, unless it can be demonstrated that a source other than the landfill caused the contamination or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in the groundwater quality.			§11-58.1-16(d)(3) **relevant and appropriate**
	If assessment monitoring is triggered, then the groundwater must be sampled and analyzed for all constituents listed in Appendix II to 40 CFR Part 258. If one or more of the constituents listed in this appendix are detected at statistically significant levels above the groundwater protection standard established under § 11-58.1-16(e)(8) or (9) in any sampling event, then at least one additional monitoring well at the facility boundary in the direction of contaminant migration must be installed and an assessment of corrective measures must be initiated pursuant to § 11-58.1-16(f).			§11-58.1-16(e)(2) **relevant and appropriate**

Table C.5 (continued)

Actions	Requirements	Prerequisites	Federal Citation	HAR Citation(s)
	Postclosure care must be conducted for 30 years, unless this time period is decreased by the Director of Health when it is demonstrated that the reduced period is sufficient to protect human health and the environment or increased by the Director if the Director determines that the lengthened period is necessary to protect human health and the environment.			11-58.1-17(b) **relevant and appropriate**
	The integrity and effectiveness of the final cover must be maintained.			11-58.1-17(b) **relevant and appropriate**
	The groundwater must be monitored in accordance with § 11-58.1-16 and the groundwater monitoring system must be maintained.			11-58.1-17(b) **relevant and appropriate**
Air Emissions from the Passive Landfill Gas Collection System and Active Vapor Extraction System	In the ambient air, the average concentration of ozone measured by a reference method during any one hour period shall not exceed 100 micrograms per cubic meter of air and the average concentration of lead measured as elemental lead by a reference method during any calendar quarter shall not exceed 1.5 micrograms per cubic meter of air.	Air emissions of VOCs or lead		11-59-4(f) and (h) – **applicable**
Air Emissions from the Passive Landfill Gas Collection System and Active Vapor Extraction System	In the ambient air, methane concentrations at the perimeter of the landfill shall not exceed the lower explosive limit (5 percent).	Air emissions of methane		11-58.1-17 **relevant and appropriate**

Table C.5 (continued)

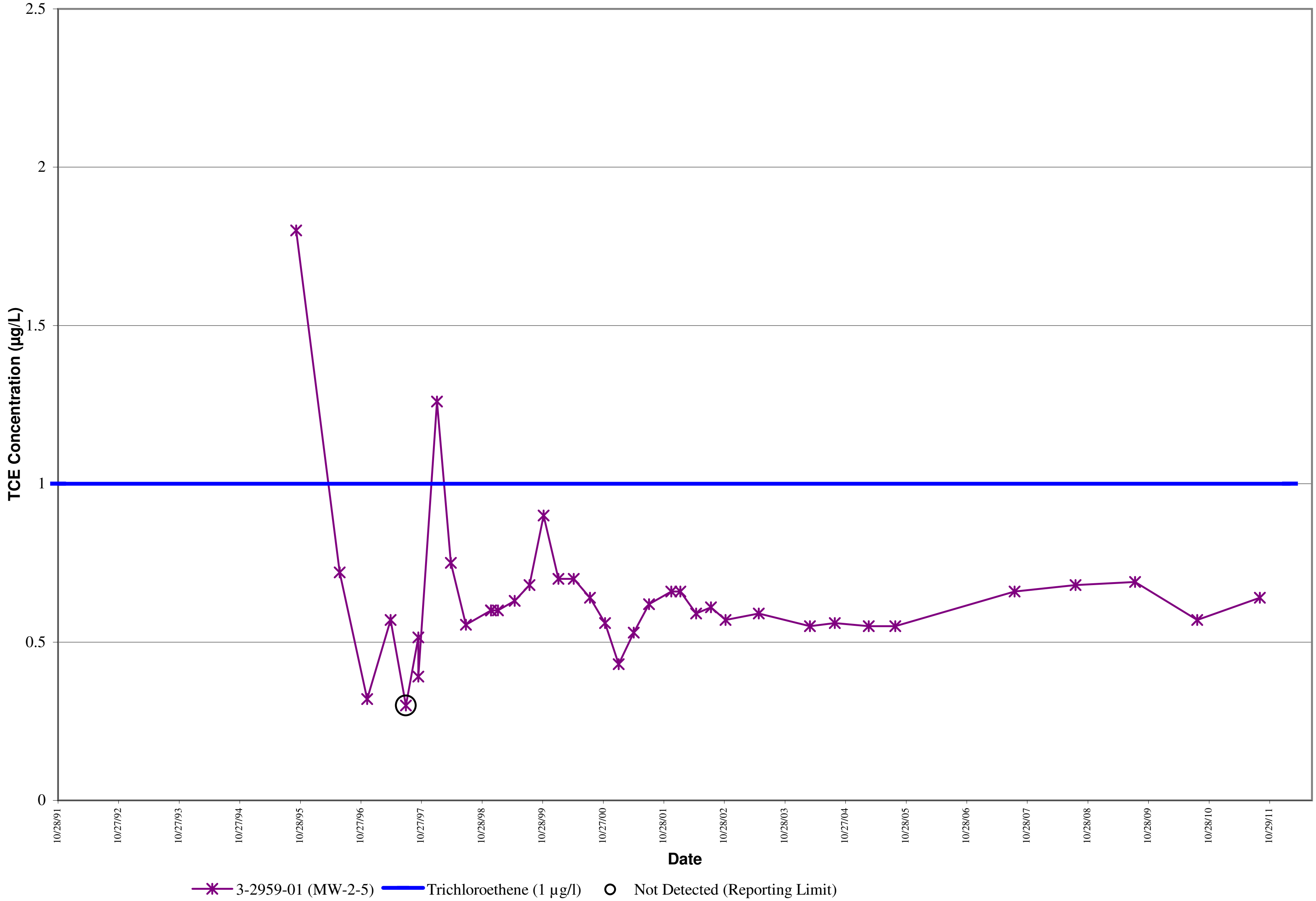
Actions	Requirements	Prerequisites	Federal Citation	HAR Citation(s)
	Substantive requirements of permit if exemption listed at §11-60.1-62(d)(1) cannot be met. Substantive requirements include the installation of devices for the measurement or analysis of source emissions or ambient concentrations of air pollutants; monitoring; and requirements concerning the use, maintenance, and installation of monitoring equipment.	Exemption under §11-60.1-62(d)(1) cannot be met.		11-60.1-68 **applicable**
Gas Treatment System	Obtain a manifest and comply with packaging, labeling, marking, and placarding requirements.	Use of granular carbon filter system and the carbon filters meet the definition of a RCRA hazardous waste.	40 CFR 262 and 40 CFR 263 **applicable**	

CFR	Code of Federal Regulations
HAR	Hawaii Administrative Rule
MSWLF Unit	Municipal solid waste landfill unit
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly owned treatment works
RCRA	Resource Conservation and Recovery Act
VOC	Volatile organic compound

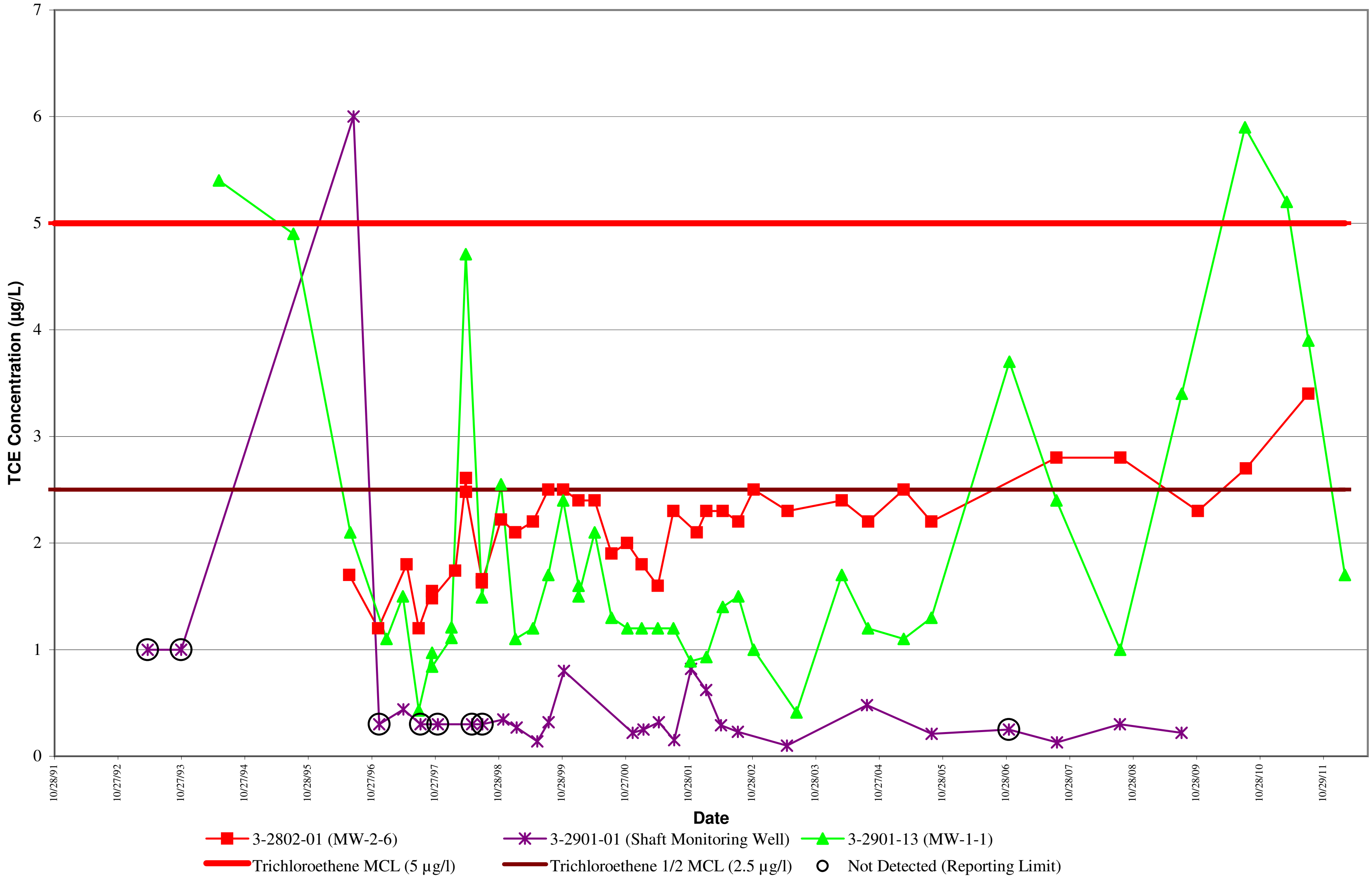
Appendix D

TIME VERSUS CONCENTRATION PLOTS FOR TRICHLOROETHENE AND CARBON TETRACHLORIDE

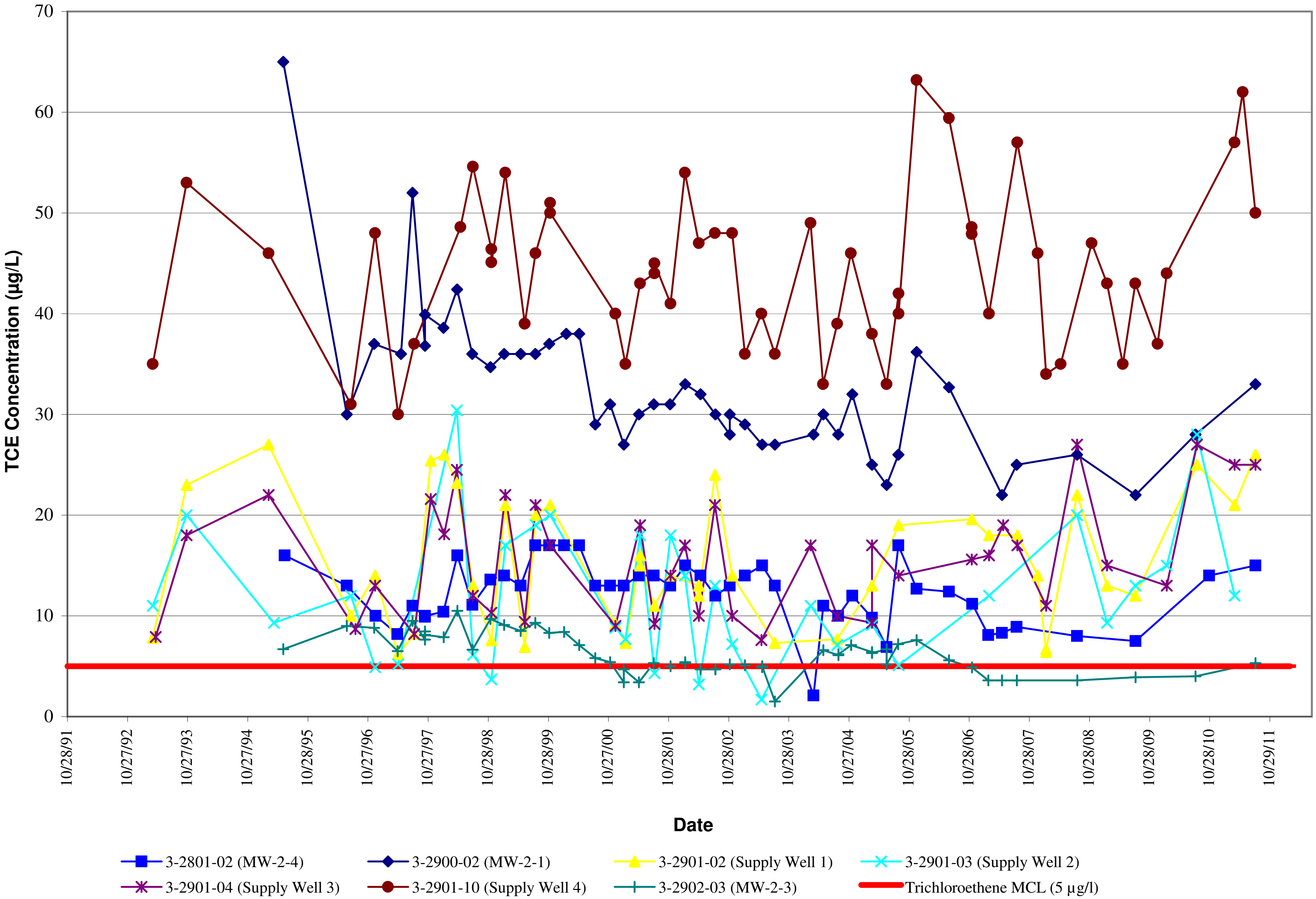
D.1: Operable Unit 2 Onsite Wells
Time versus Trichloroethene (TCE) Concentrations Below 2.5 µg/l



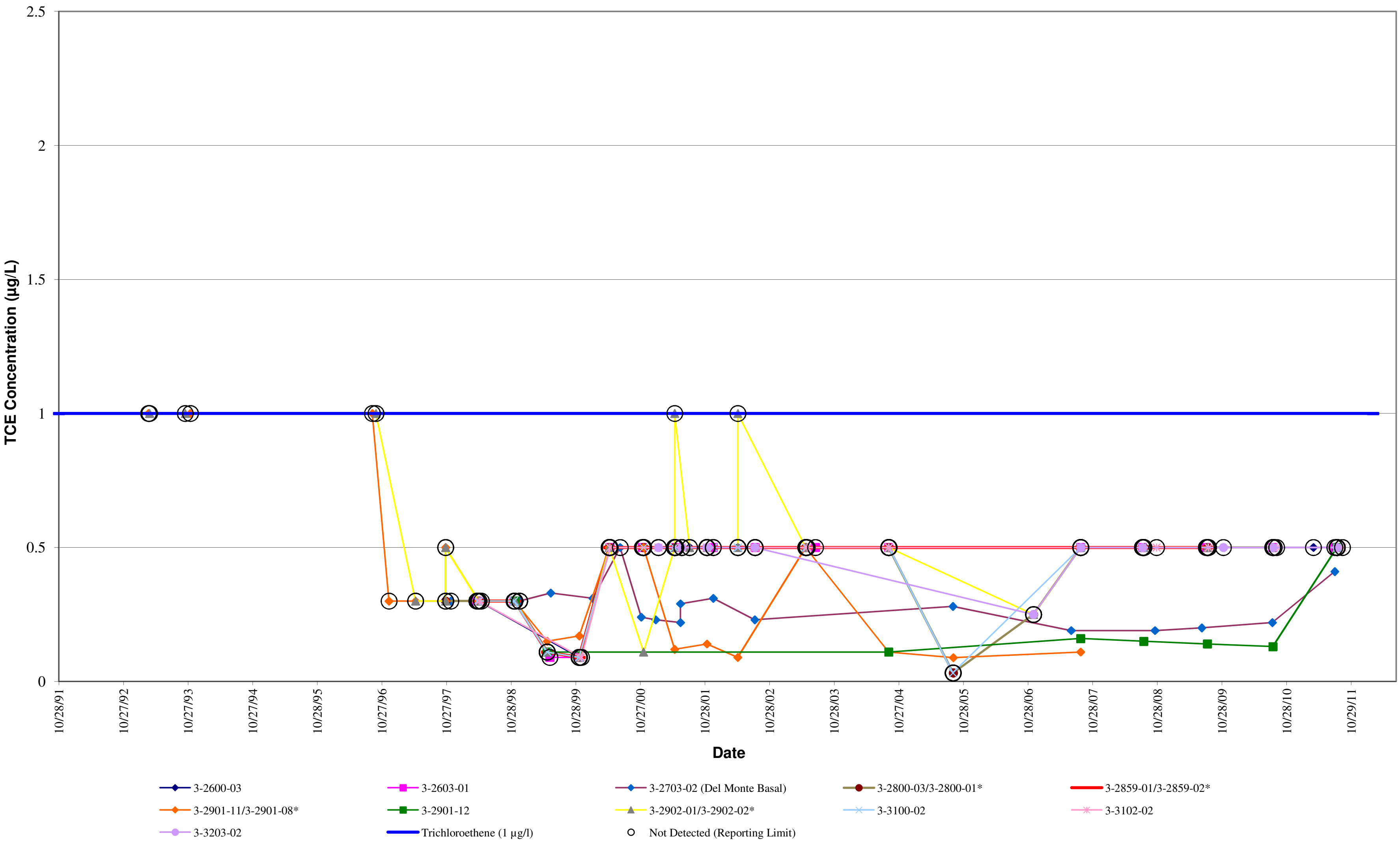
D.2: Operable Unit 2 Onsite Wells
Time versus Trichloroethene (TCE) Concentrations Below 10 µg/l



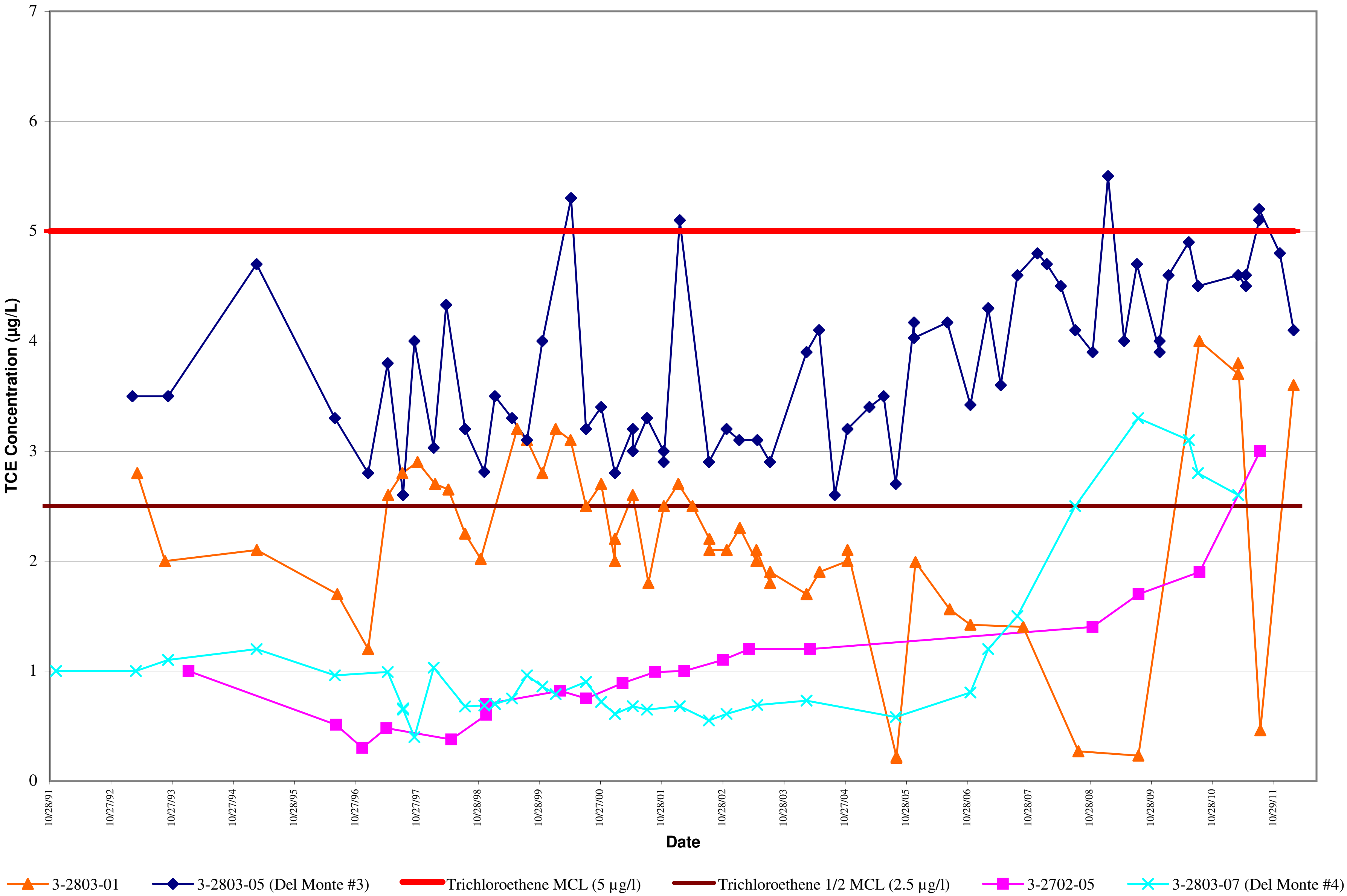
D.3: Operable Unit 2 Onsite Wells
Time versus Trichloroethene (TCE) Concentrations At Least One Occurrence Above 10 mg/l



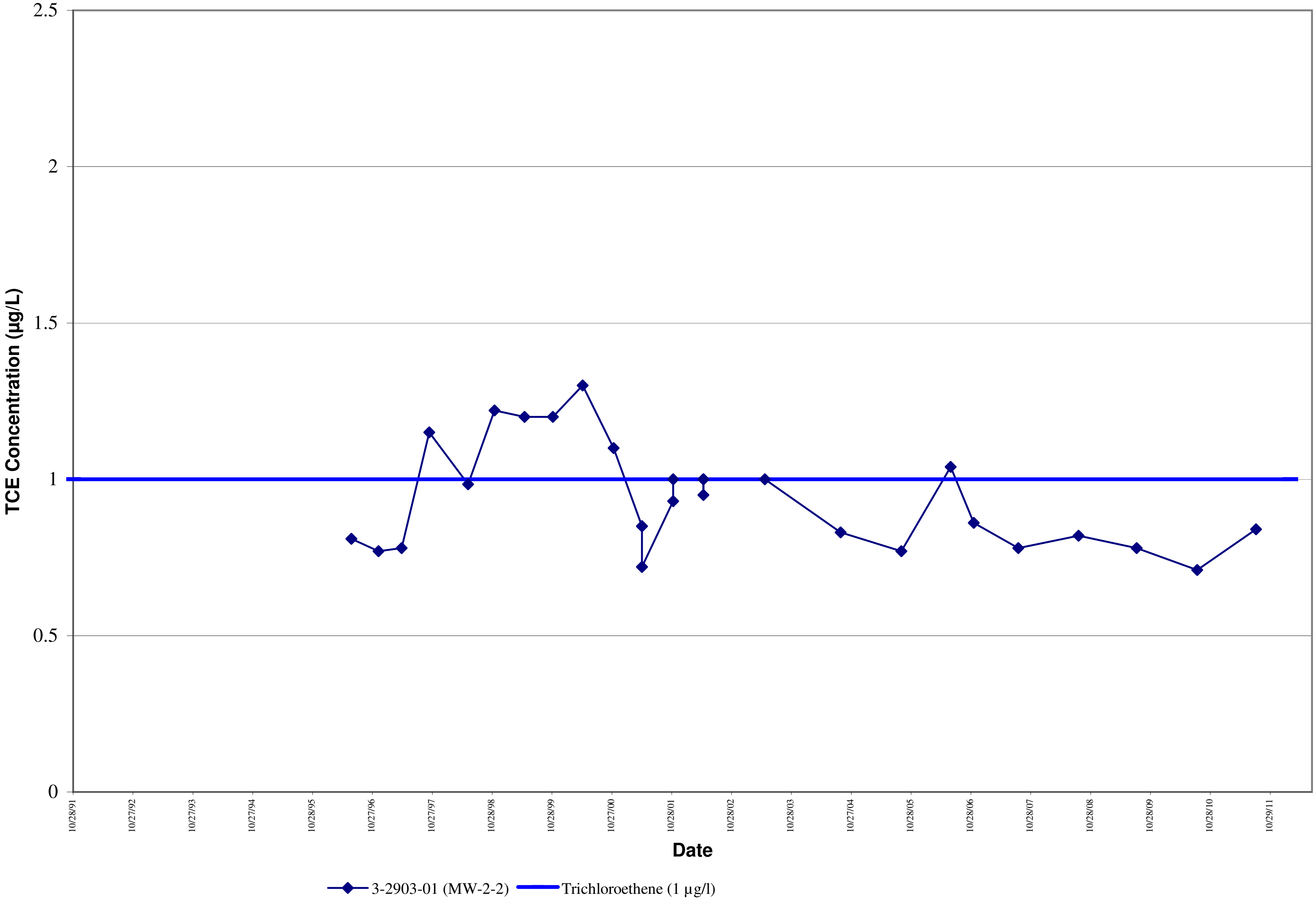
D.4: Operable Unit 2 Offsite Wells
Time versus Trichloroethene (TCE) Concentrations Below 2.5 µg/l



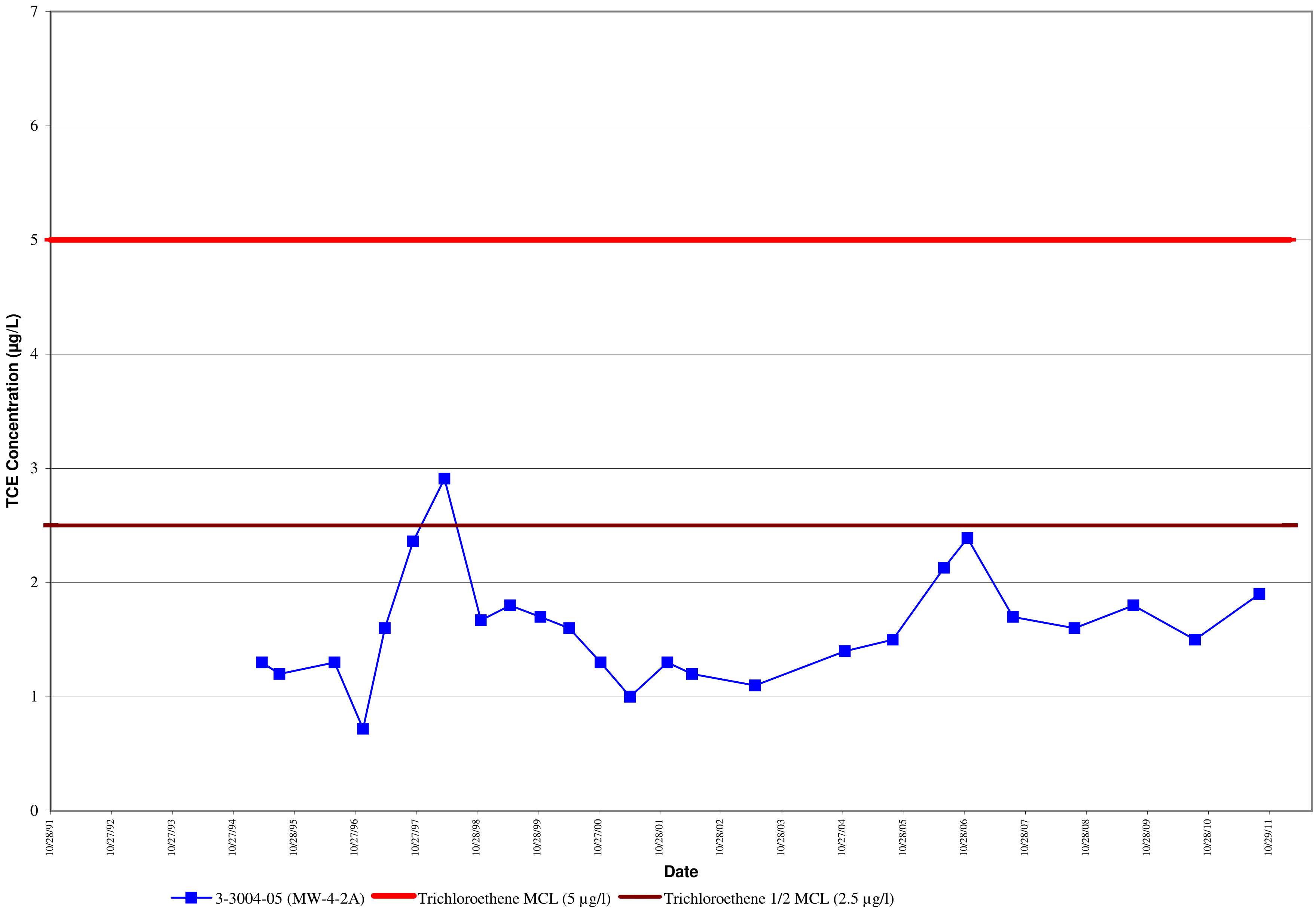
D.5: Operable Unit 2 Offsite Wells
Time versus Trichloroethene (TCE) Concentrations Below 10 µg/l



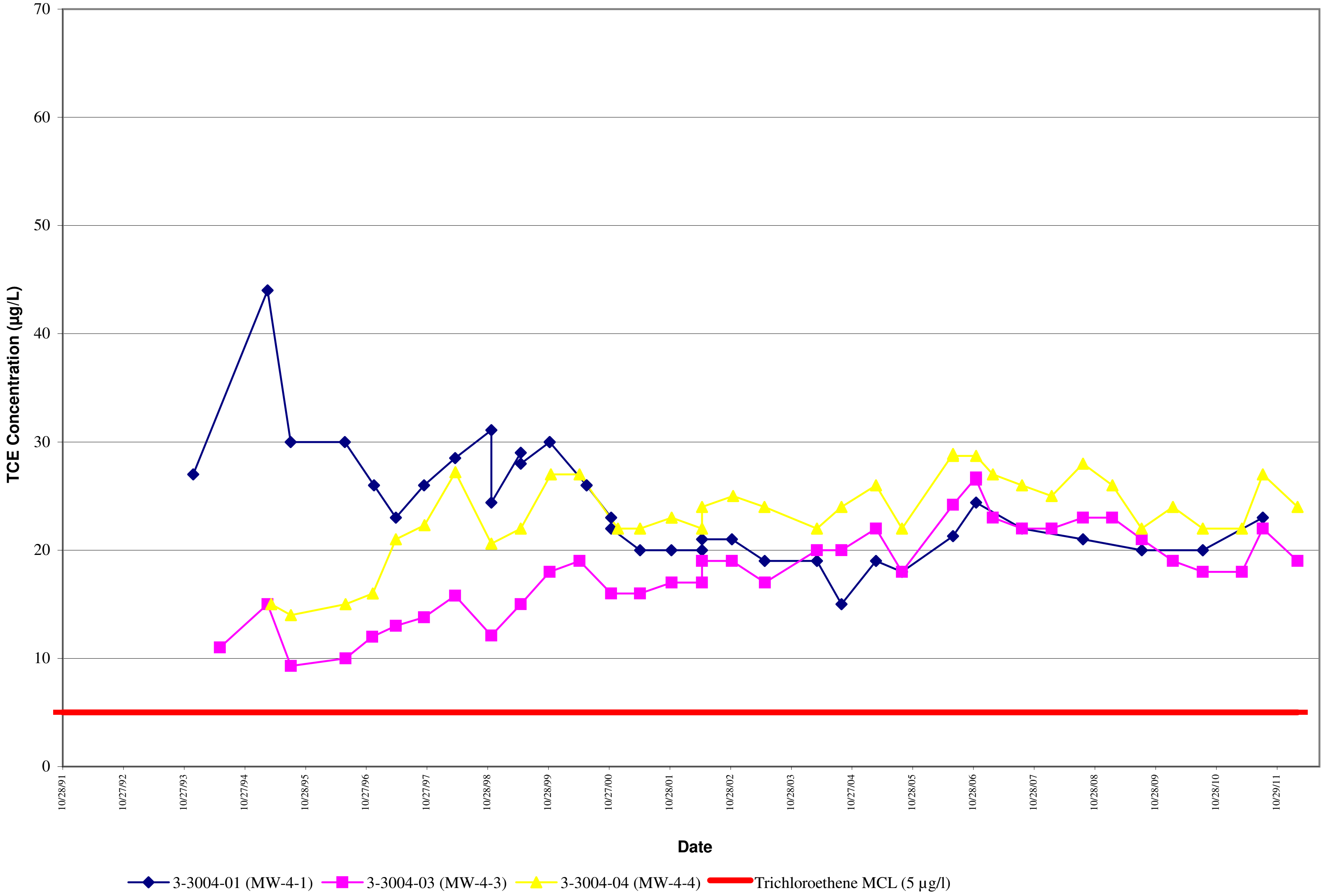
D.6: Operable Unit 4 Onsite Wells
Time versus Trichloroethene (TCE) Concentrations Below 2.5 µg/l



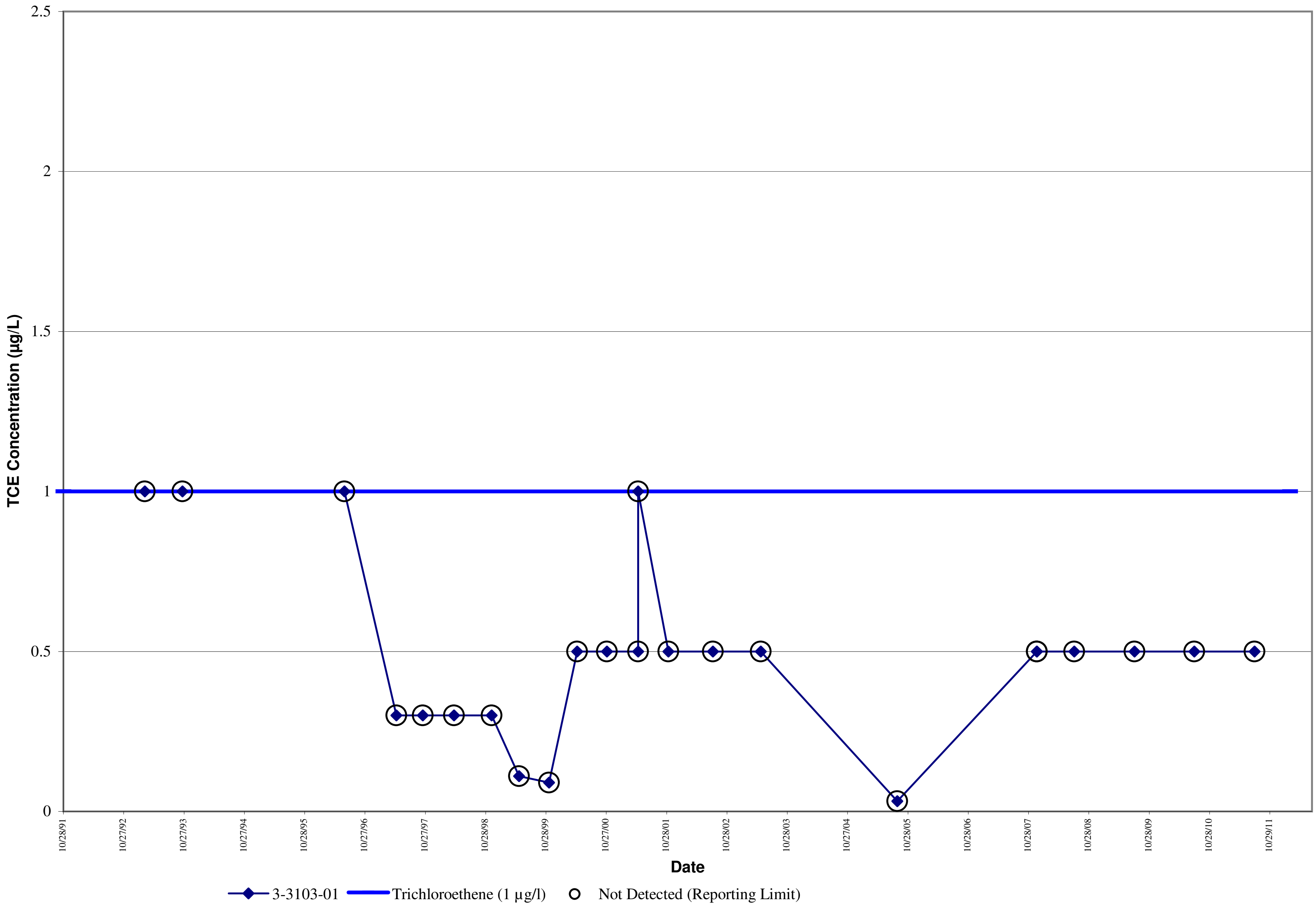
D.7: Operable Unit 4 Onsite Wells
Time versus Trichloroethene (TCE) Concentrations Below 10 µg/l



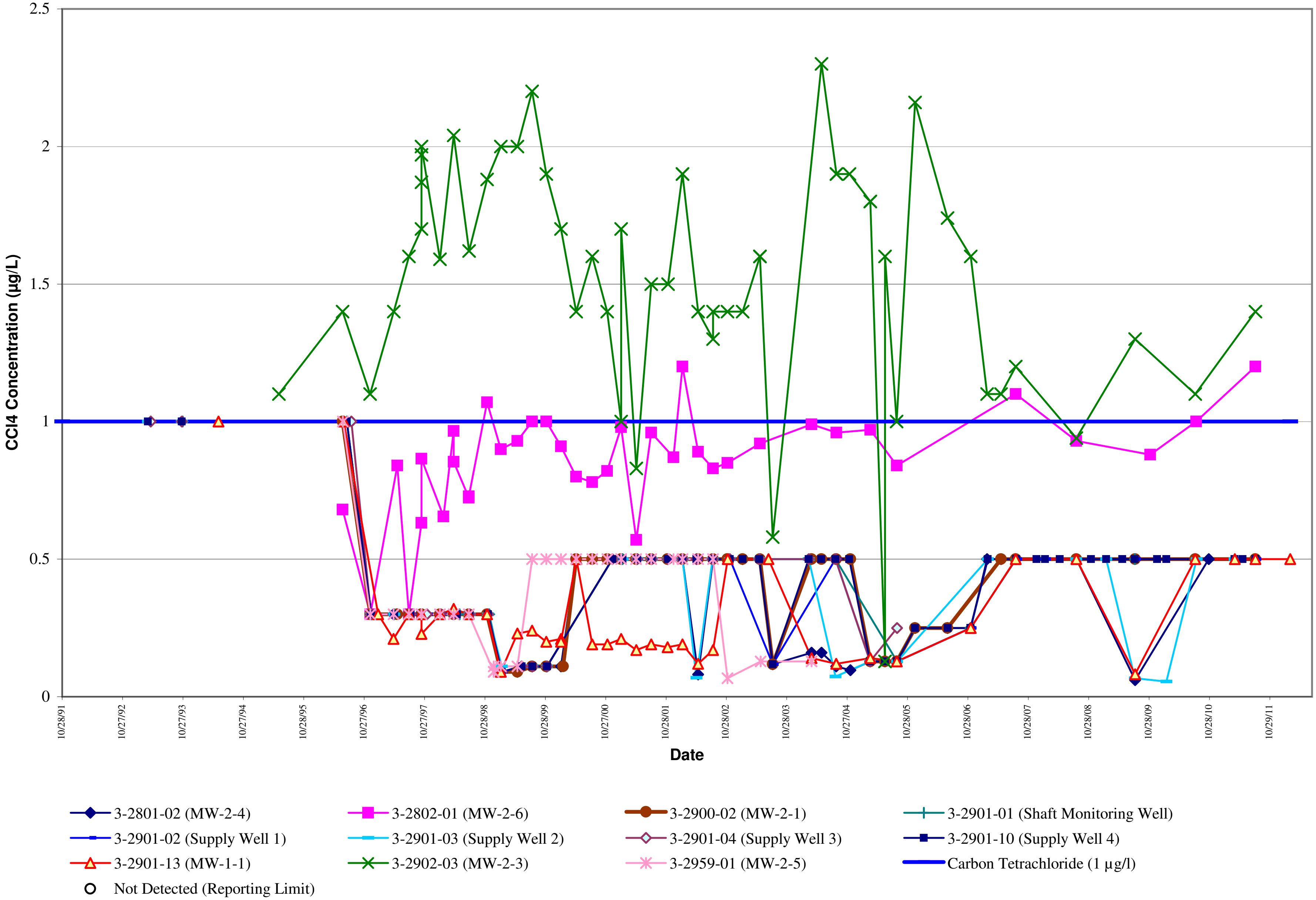
D.8: Operable Unit 4 Onsite Wells
Time versus Trichloroethene (TCE) Concentrations At Least One Occurrence Above 10 µg/l



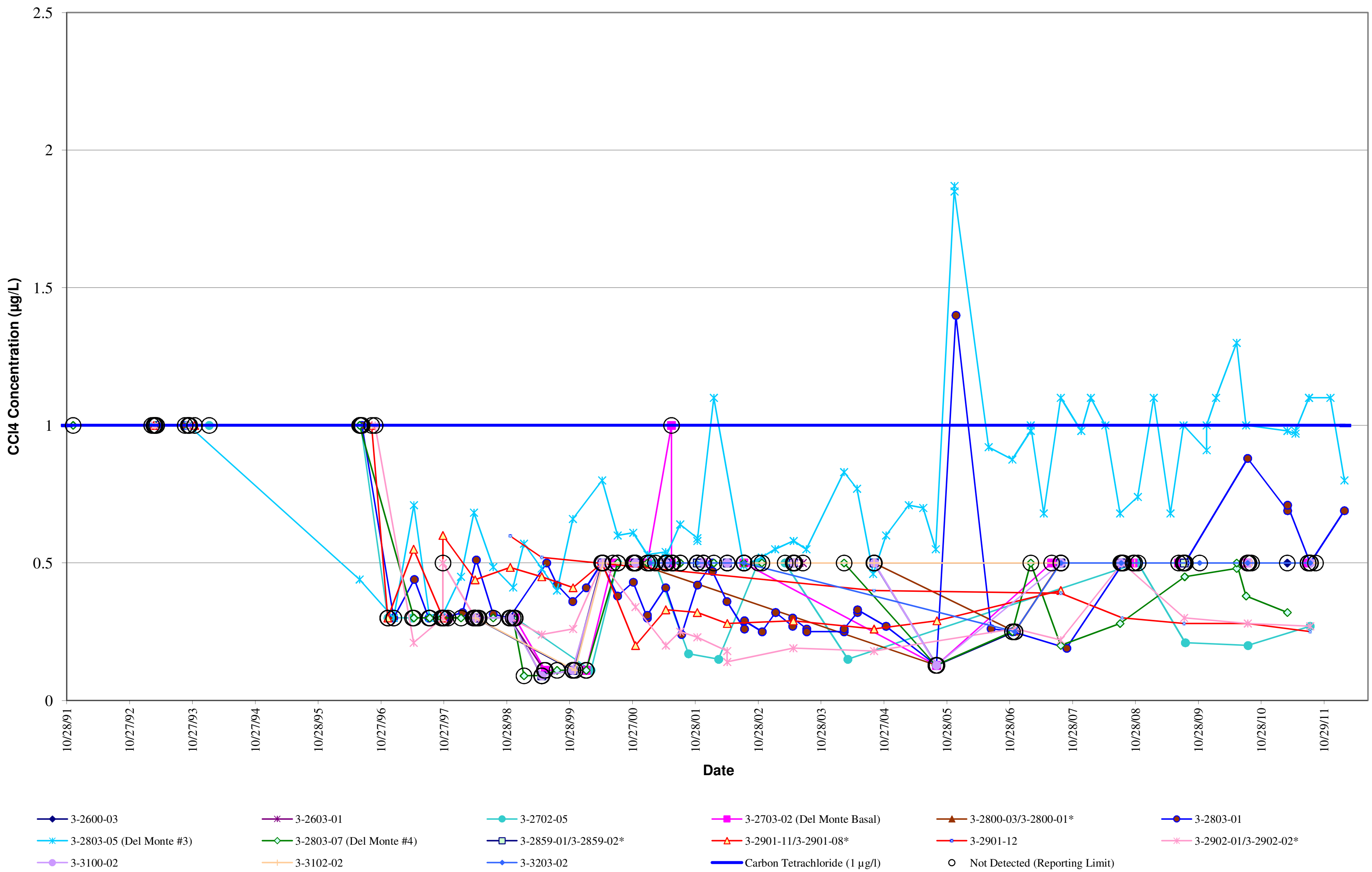
D.9: Operable Unit 4 Offsite Wells
Time versus Trichloroethene (TCE) Concentrations Below 2.5 µg/l



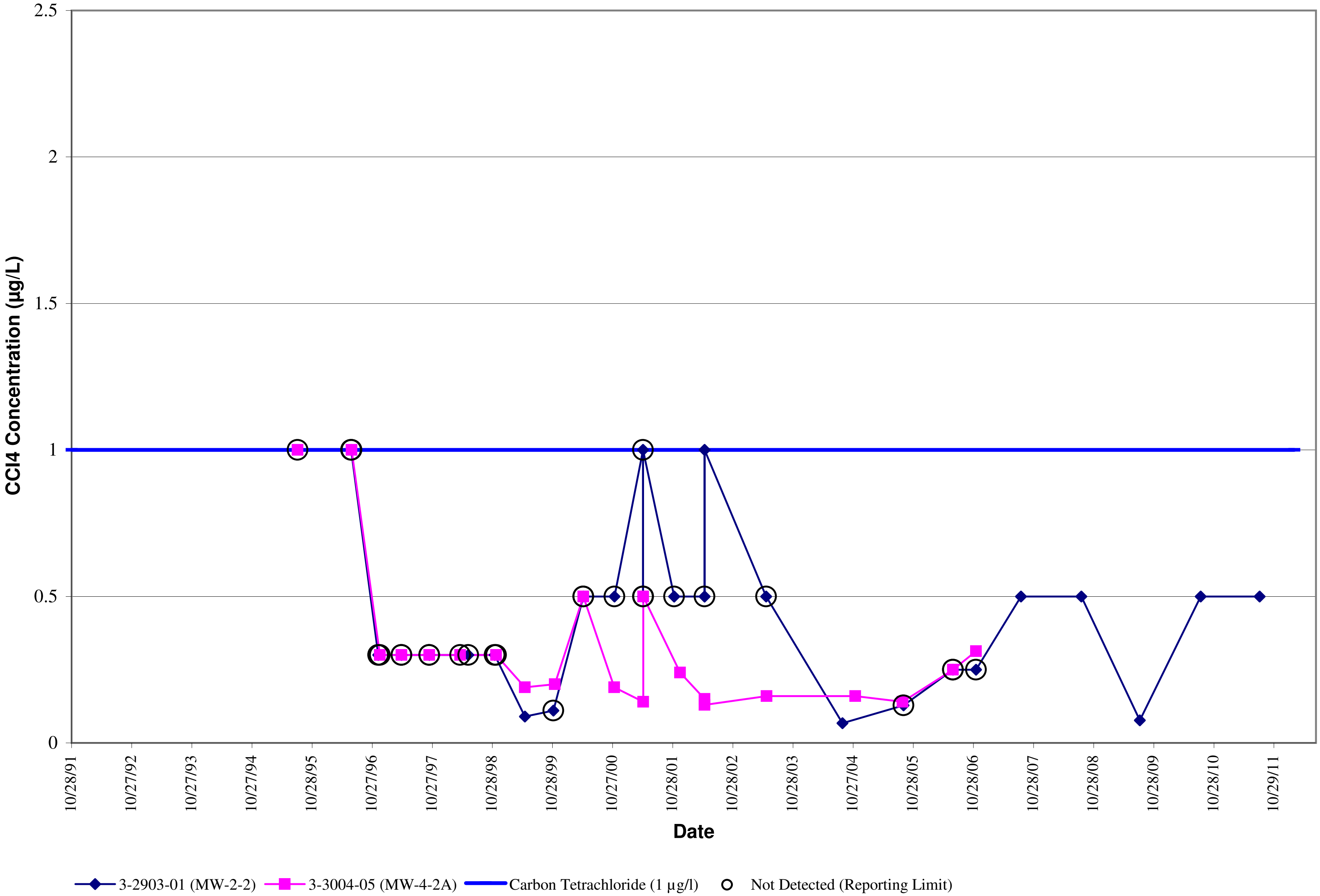
D.10: Operable Unit 2 Onsite Wells
Time versus Carbon Tetrachloride (CCl4) Concentrations Below 2.5 µg/l



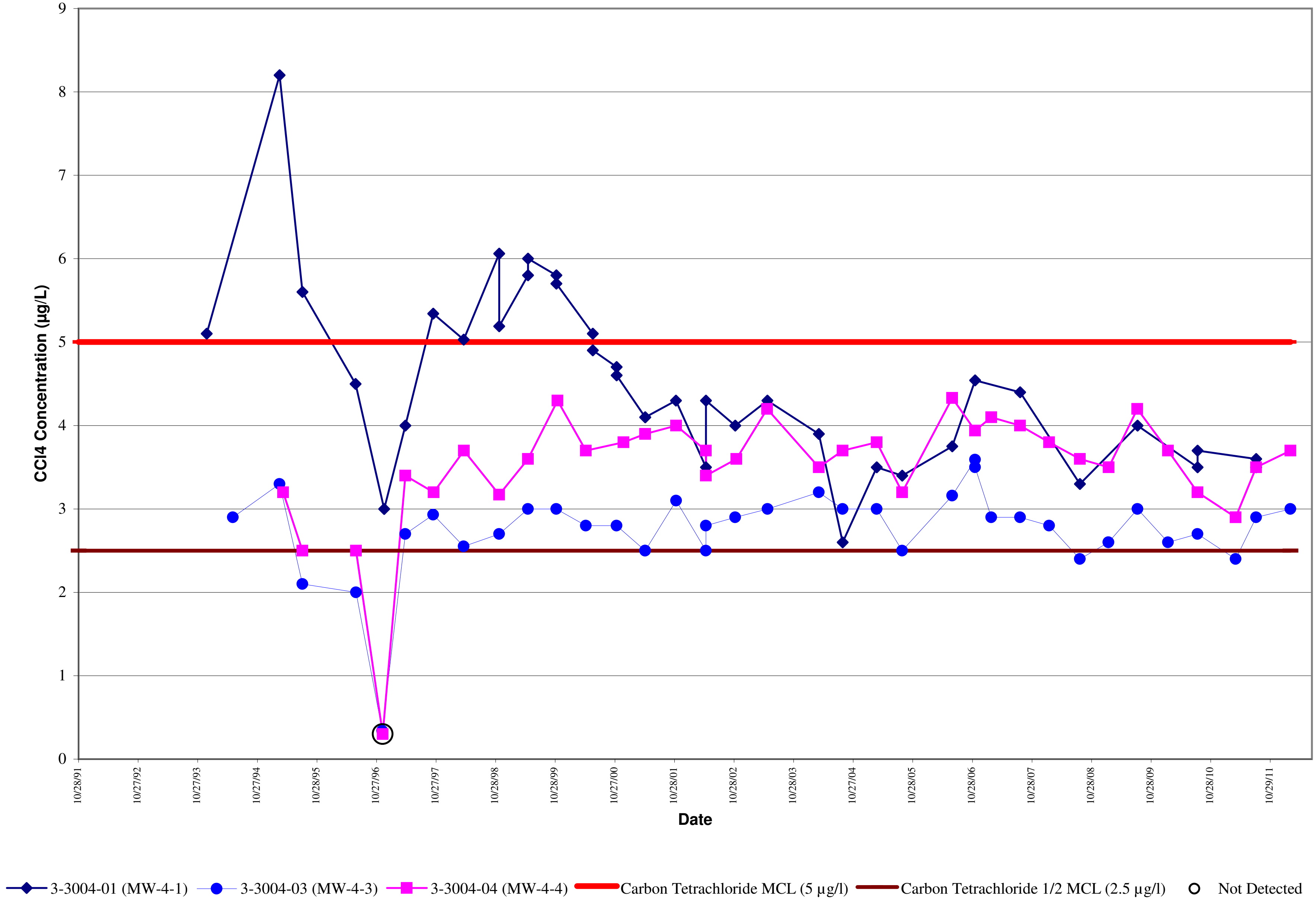
D.11: Operable Unit 2 Offsite Wells
Time versus Carbon Tetrachloride(CCl4) Concentrations Below 2.5 µg/l



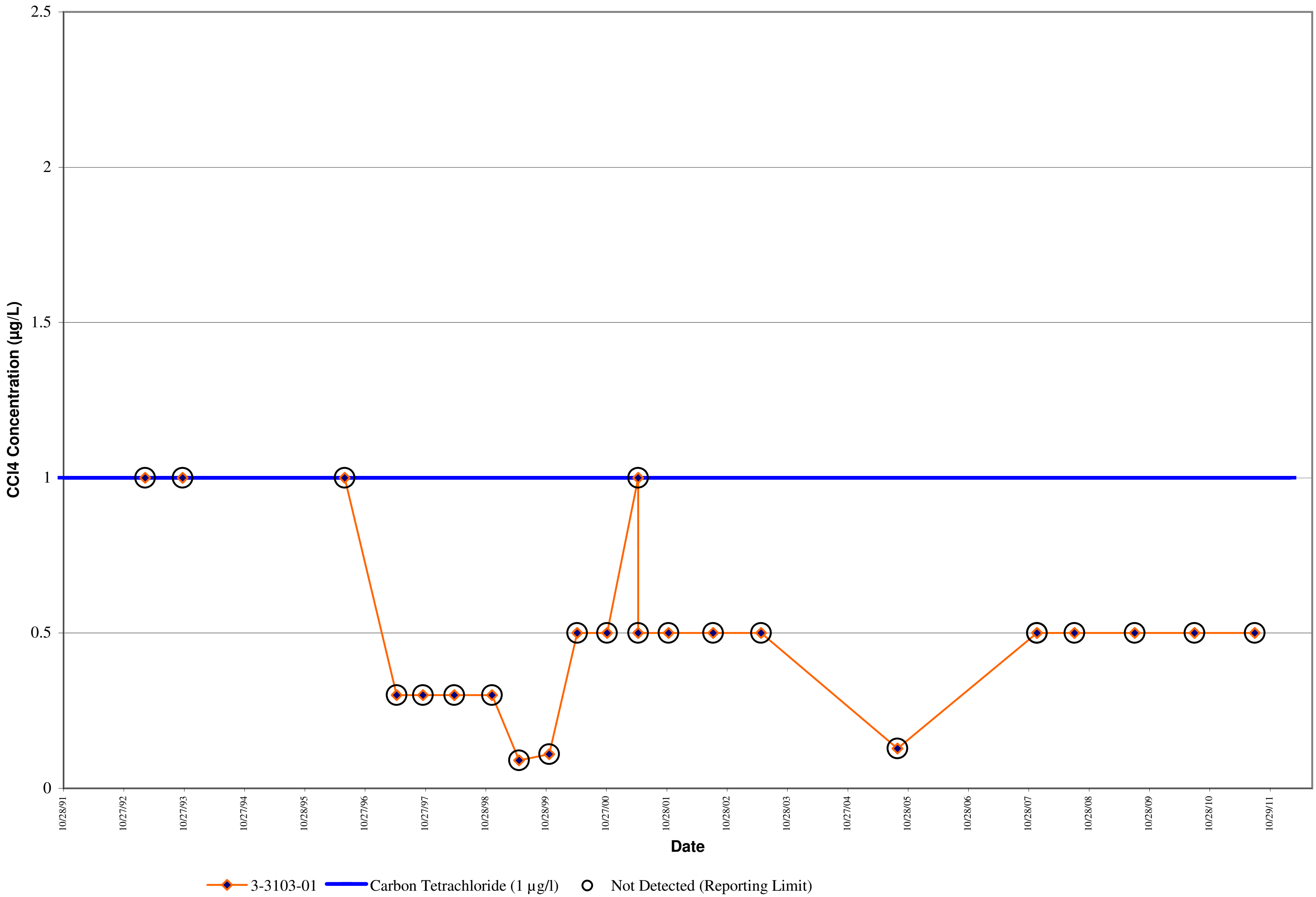
D.12: Operable Unit 4 Onsite Wells
Time versus Carbon Tetrachoride (CCl4) Concentrations Below 2.5 µg/l



D.13: Operable Unit 4 Onsite Wells
Time versus Carbon Tetrachloride (CCl4) Concentrations Below 10 µg/l

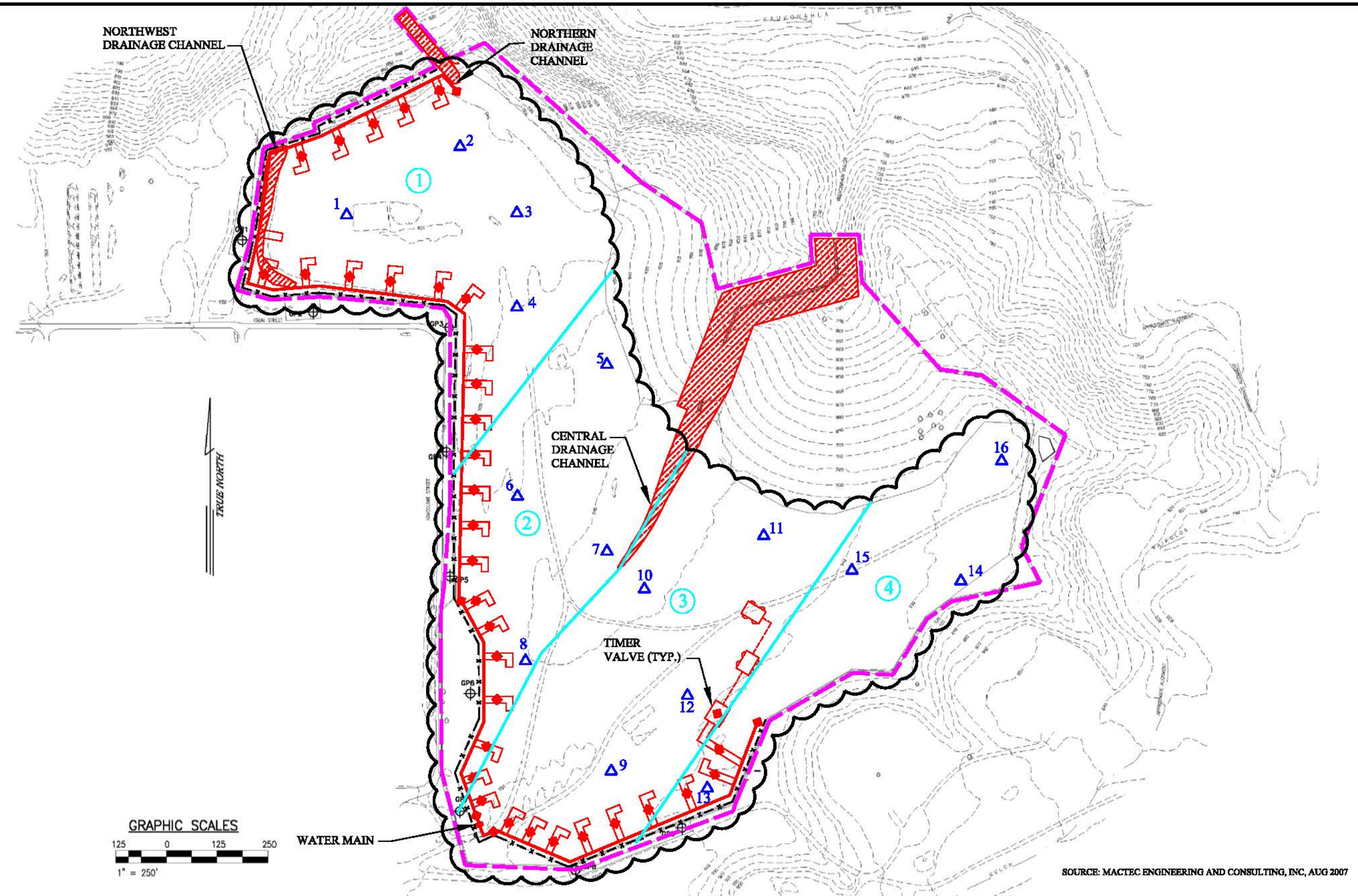


D.14: Operable Unit 4 Offsite Wells
Time versus Carbon Tetrachloride (CCl4) Concentrations Below 2.5 µg/l



Appendix E

LANDFILL SOIL MOISTURE DATA



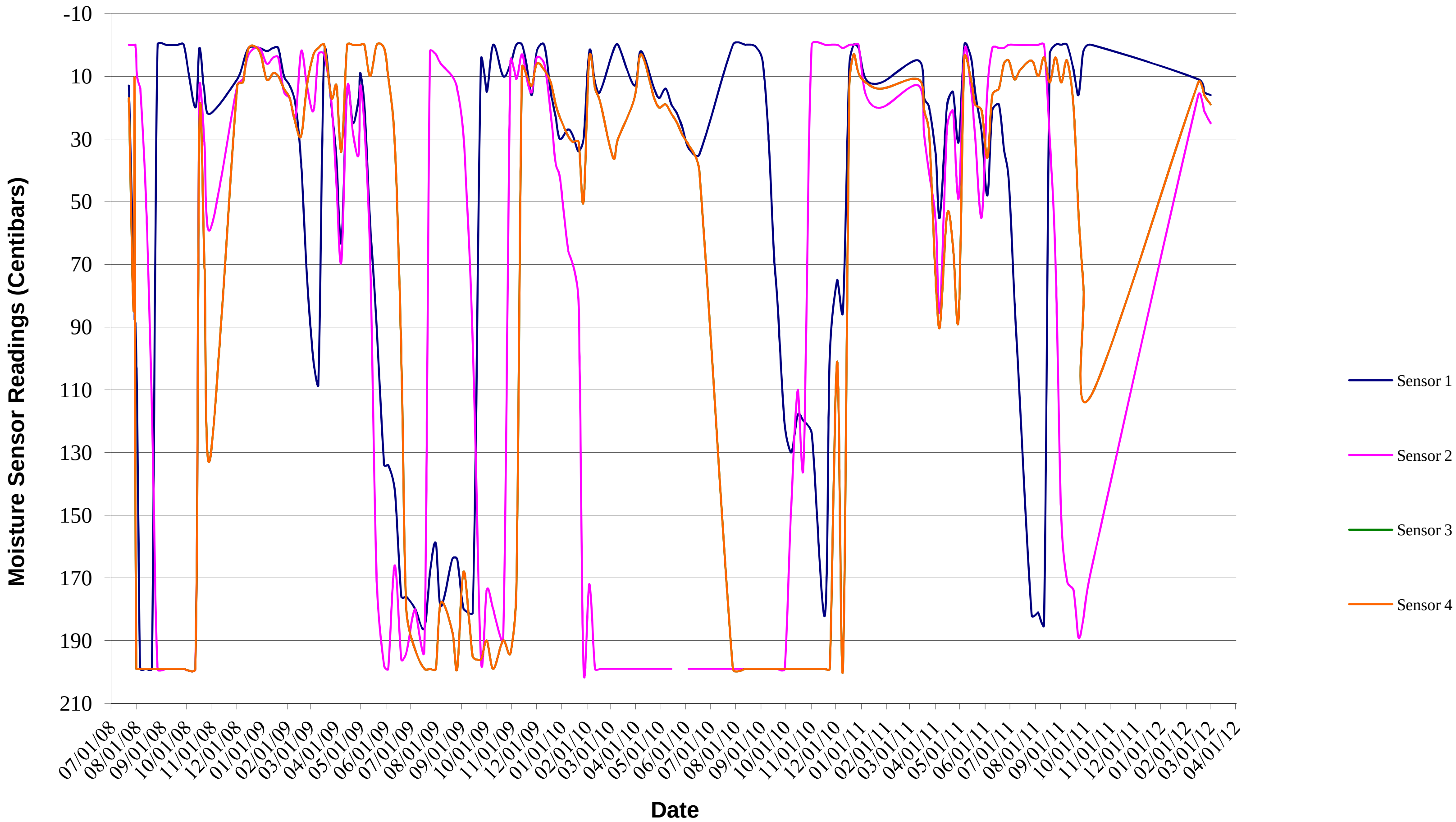
LEGEND:

- GP1 GAS WELL
- BALL VALVE
- RISER
- LANDFILL EXTENTS
- DRAINAGE CHANNEL
- IRRIGATION COVERAGE AREAS
- SPRINKLER-MOUNDED CART
- FIRE HOSE
- CHAIN LINK FENCE
- 2-1/2 INCH SCH. 40 PVC PIPE
- MALE FIRE HOSE ADAPTER
- IRRIGATION ZONE
- ESTIMATED LOCATION OF MOISTURE SENSOR

ECC
99-1151 IWAENA ST.
AIEA, HI 96701
(808) 486-3707

DRAWN BY: J. BITTER	**FIGURE III-1, IRRIGATION SYSTEM LAYOUT**	
APPROVED BY: T. ROSENBUSH	SCHBR -12 SCHOFIELD ARMY BARRACKS, OAHU, HAWAII	
DATE: 3/16/2009	PROJECT CODE: 5404.004	CONTRACT CODE: W91ZLK-05-D-0009
SIZE: B	SCALE: 1" - 250'	FILENAME: MOISTURE ZONES_MACTEC.DWG
	SHEET: 1 OF 1	REV: -

N:\AA_PROJECTS\5404.004 ACSIMAH-ECC REPORTS AND SUBMITTALS\SCHBR-12 IRRIGATION PLAN\DRAFT SCHBR IRRIGATION PLAN\FIGURE\MOISTURE ZONES_MACTEC.DWG



U.S. Army Environmental Command

Directorate of Public Works
United States Army Garrison, Hawaii

Moisture Sensor Readings for Zone 1,
July 2008 through March 2012
Former Landfill (SCHBR-12)
Schofield Army Barracks

FIGURE
E-2

JOB NUMBER	DATE	DRAWN
4663070005	04/12	WHB

4/6/2012, 1:34 PM
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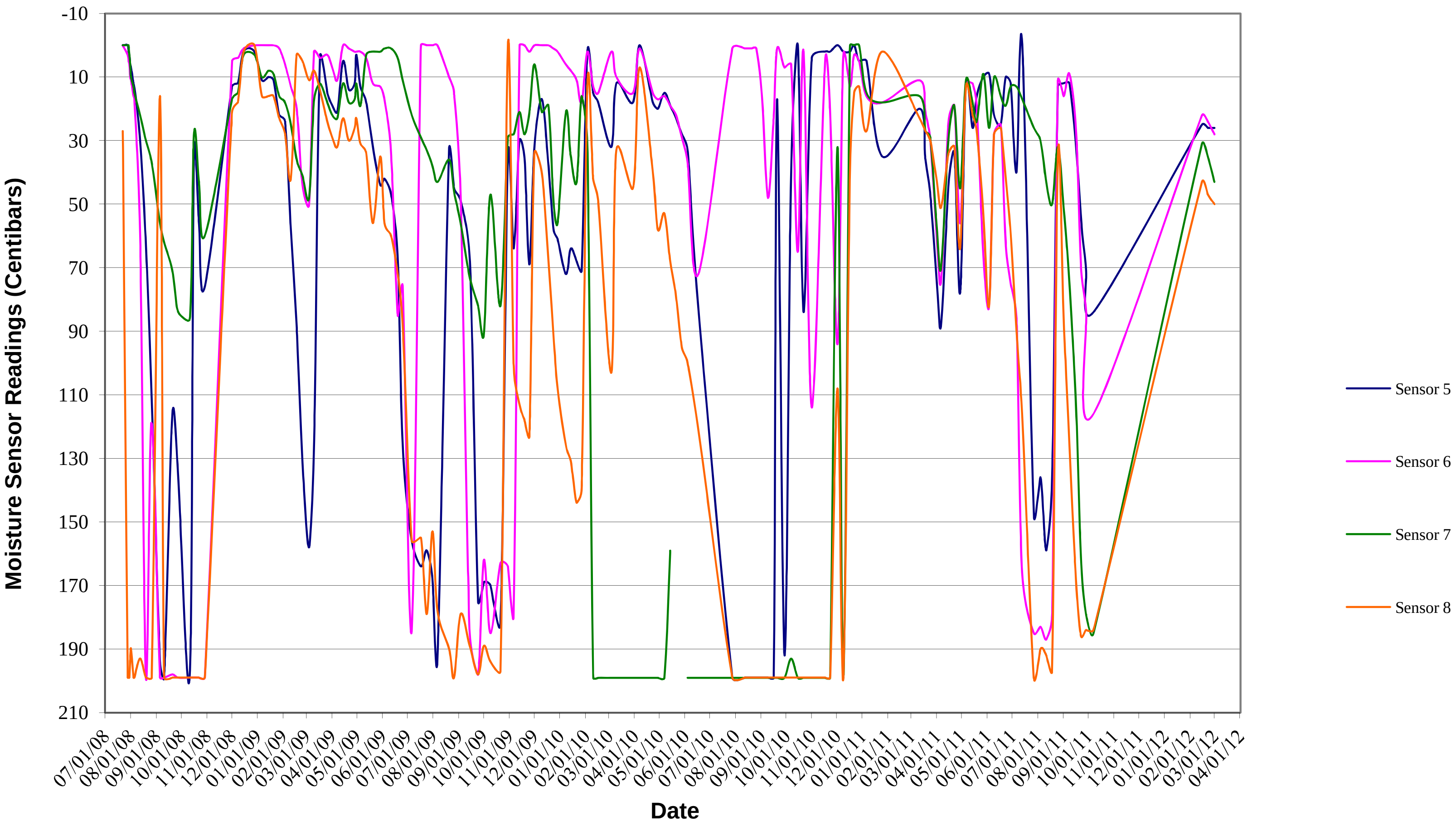


U.S. Army Environmental Command

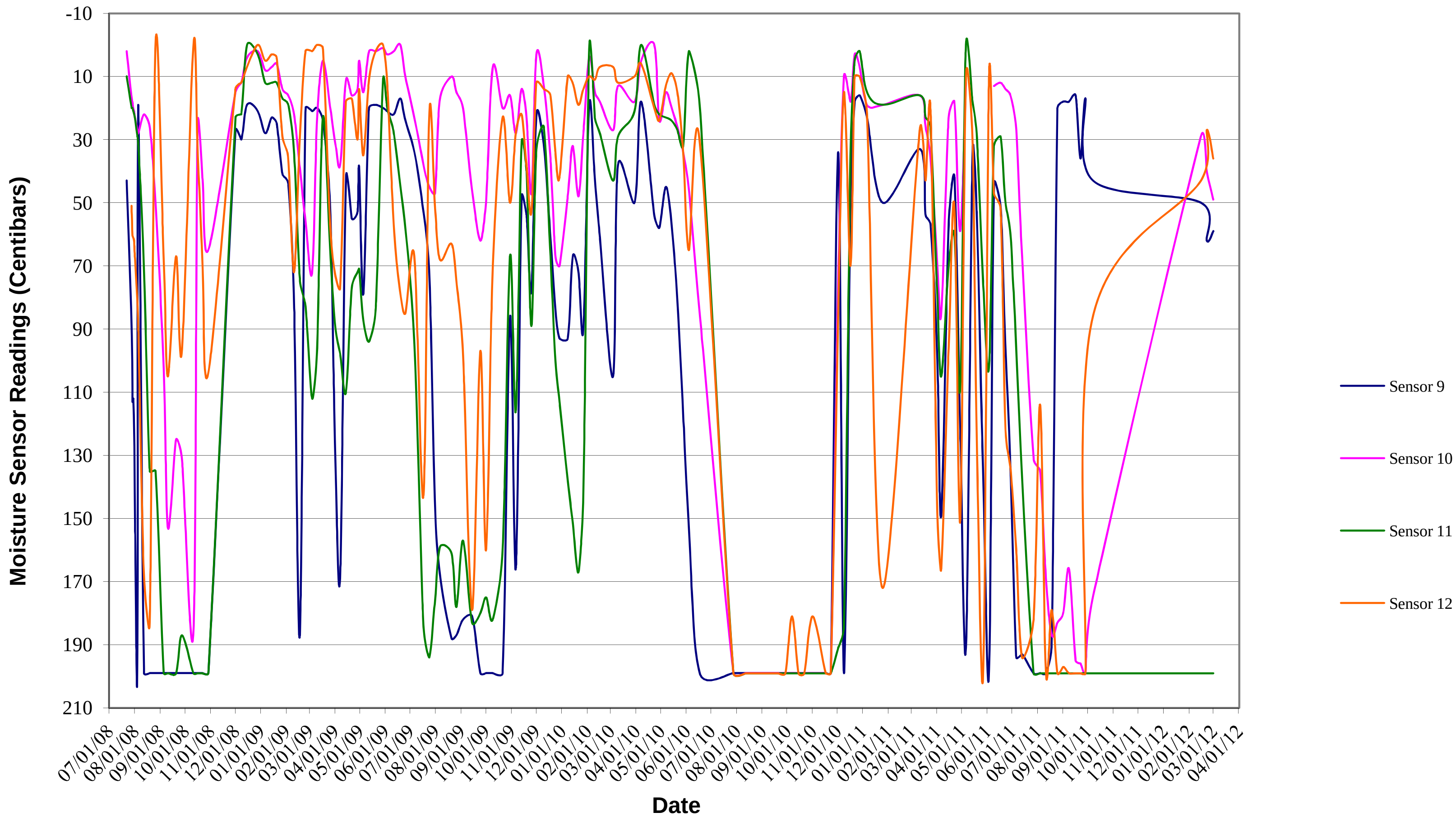
Directorate of Public Works
United States Army Garrison, Hawaii

Moisture Sensor Readings for Zone 2,
July 2008 through March 2012
Former Landfill (SCHBR-12)
Schofield Army Barracks

FIGURE
E-3

JOB NUMBER	DATE	DRAWN
4663070005	04/12	WHB

4/6/2012, 1:33 PM
p:\30000\37257\geoanal\graphs\round50\[feb09 ltm report mod.xls]defaults



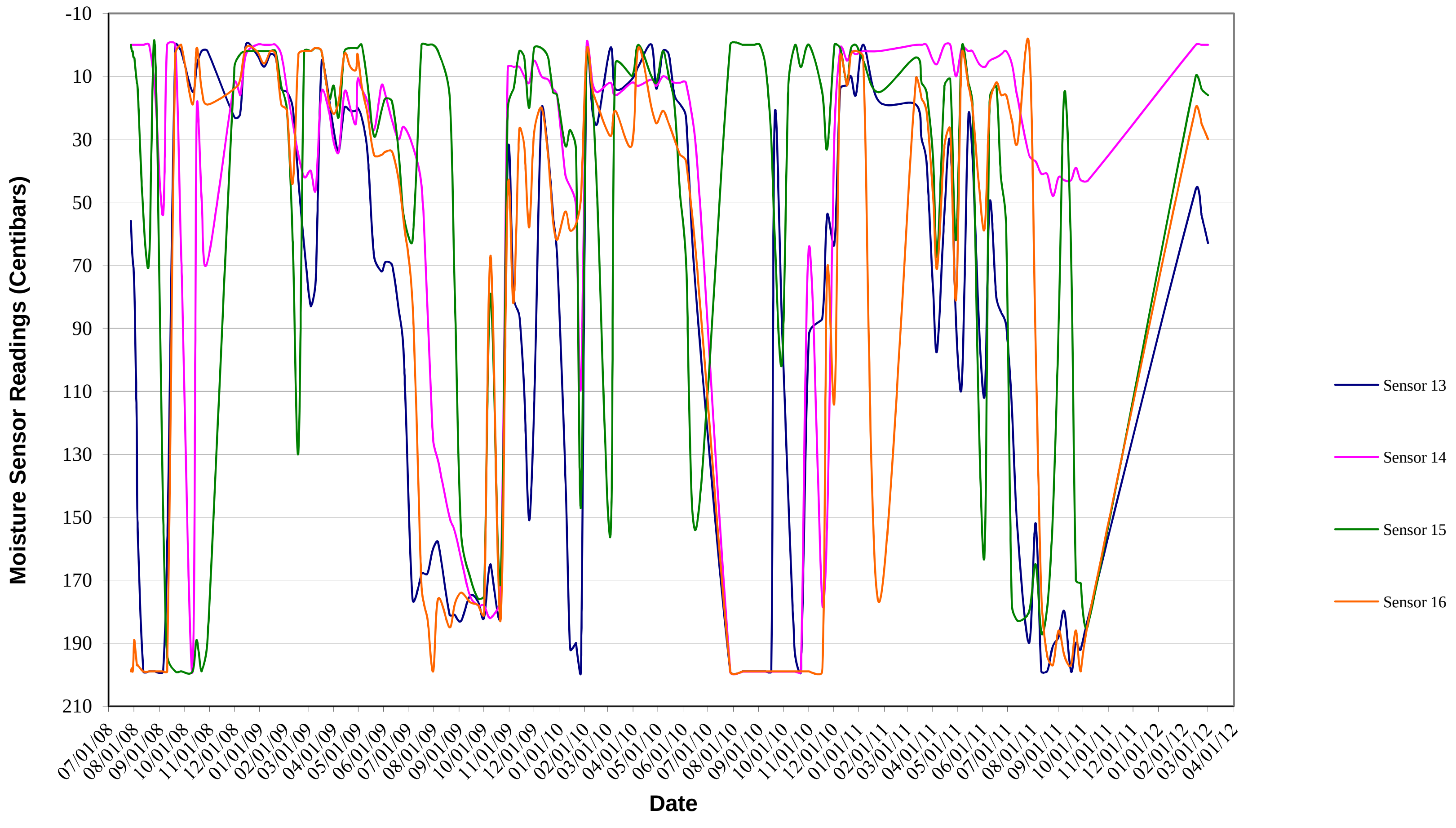
U.S. Army Environmental Command

Directorate of Public Works
United States Army Garrison, Hawaii

Moisture Sensor Readings for Zone 3,
July 2008 through March 2012
Former Landfill (SCHBR-12)

FIGURE
E-4

JOB NUMBER	DATE	DRAWN
4663070005	04/12	WHB



U.S. Army Environmental Command

Directorate of Public Works
United States Army Garrison, Hawaii

Moisture Sensor Readings for Zone 4,
July 2008 through March 2012
Former Landfill (SCHBR-12)
Schofield Army Barracks

FIGURE
E-5

JOB NUMBER	DATE	DRAWN
4663070005	04/12	WHB

Appendix F

OPERABLE UNIT 2 AND OPERABALE UNIT 4 SITE INSPECTION CHECKLISTS

Table F.1: Onpost Monitoring Wells Site Inspection Checklist
Third Five-Year Review
Schofield Army Barracks

Well	Properly Secured/ Locked	Functioning	Routinely Sampled	Good Condition	Needs Maintenance	Remarks
3-2901-13 MW-1-1	Yes	Yes	Yes	Yes		Monitoring well is located in an underground vault. Inspected 3/30/2012.
3-2900-02 MW-2-1	Yes	Yes	Yes	Yes	The northwest and southwest bollards appear to be damaged. No longer perpendicular to ground and concrete has been severely cracked.	Vent cap consisted only of PVC pipe wrap. Inspected 3/28/2012.
3-2903-01 MW-2-2	N/A	Yes	Yes	N/A		Monitoring well is currently located inside of a secured construction area. Could not gain access to the well at time of field inspection.
3-2902-03 MW-2-3	Yes	Yes	Yes	Yes		Noted minor corrosion on padlock. Inspected 3/28/2012.
3-2801-02 MW-2-4	Yes	Yes	Yes	Yes		Noted minor corrosion on padlock and wellhead. Inspected 3/28/2012.
3-2959-01 MW-2-5	No	Yes	Yes	Yes	Hook that is opposite the padlock that secures the lid is bent and no longer functional. Well head was secured with padlock but could be opened from the opposite side at time of inspection.	Inside East Range Training Facility. Requires 4x4 vehicle and EOD escort to access. At the time of inspection there was a large downed tree that made the road impassable. Range services arranged to have the tree removed and road conditions improved on 3/31/2012. Inspected 3/30/12.
3-2802-01 MW-2-6	Yes	Yes	Yes	Yes	Hook that is opposite the padlock that secures the lid is bent but still functional.	Surrounding vegetation is approximately waist high. Inspected 3/28/2012.
3-3004-01 MW-4-1	Yes	Yes	Yes	Yes	There is no cap on the inner monitoring well pipe.	Inside EOD training area. Noted a strong air current coming from the inner monitoring well pipe. Inspected 3/28/2012.
3-3004-05 MW-4-2A	Yes	Yes	Yes	Yes		Inspected 3/23/2012.
3-3004-03 MW-4-3	No	Yes	Yes	Yes	Northwest bollard appears bent. Padlock could not be opened with combination given. The side of the lid opposite the padlock was not secured, the loop on the lid appears to be bent. Was able to access interior of well without the combination.	Inspected 3/28/2012.
3-3004-04 MW-4-4	Yes	Yes	Yes	Yes	Padlock was not functioning at time of inspection. Could not open well lid with given combination. Interior of wellhead was not inspected.	Inside former landfill site near the base of the central drainage channel. Inspected 3/23/2012.

Table F.2: Site Inspection Checklist

I. SITE INFORMATION	
Site name: Schofield Army Barracks (Landfill and Groundwater Treatment and Monitoring Systems)	**Date of inspection:** March 23, 2012
Location and Region: Oahu, Hawaii	**EPA ID:** HI7210090026 (de-listed from NPL)
Agency, office, or company leading the five-year review: AMEC Environment and Infrastructure, Inc.	**Weather/temperature:** Partly cloudy, about 75 degrees Fahrenheit
Remedy Includes: (Check all that apply) ☒ Landfill cover/containment ☒ Access controls ☒ Institutional controls ☒ Groundwater pump and treatment ☐ Surface water collection and treatment ☐ Monitored natural attenuation ☐ Groundwater containment ☐ Vertical barrier walls Other__________	
Attachments: ☐ Inspection team roster attached ☐ Site map attached	

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Carrie Nelson (Name) IRP & MMRP Program Manager (Title) 03/23/12 (Date)
   Interviewed ☐ at site ☒ at office ☐ by phone Phone no. 808-656-3092
   Problems, suggestions; ☐ Report attached Corroded water stripping tower brackets at Schofield Water Treatment Plant.

2. **O&M staff** Jenny Lai (Name) IRP & MMRP Program Assistant (Title) 03/23/12 (Date)
   Interviewed ☐ at site ☒ at office ☐ by phone Phone no. ________
   Problems, suggestions; ☐ Report attached None

3. **O&M staff** Wade Nakai (Name) Schofield Water Treatment Plant Manager (Title) 03/23/12 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 808-655-1772
   Problems, suggestions; ☐ Report attached Corroded water stripping tower brackets at Schofield Water Treatment Plant.

4. **O&M staff** Shane Lee (Name) Second City Property Management (Title) 03/23/12 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 808-330-4399
   Problems, suggestions; ☐ Report attached None

5. **O&M staff** Troy Rosenbush (Name) ECC, PMP, PG (Title) 03/23/12 (Date) Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 808-792-8011 Problems, suggestions; ☐ Report attached None
5. **O&M staff** Puna Kaneakua, P.E. (Name) Project Engineer (Title) 03/29/12 (Date) Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 808-531-4252 ex 1030 Problems, suggestions; ☐ Report attached None

4. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency None
Contact ____________________ ______________ ______ ________
Name Title Date Phone no.

Problems; suggestions; ☐ Report attached

Agency ____________________
Contact ____________________ ______________ ______ ________
Name Title Date Phone no.

Problems; suggestions; ☐ Report attached

Agency ____________________
Contact ____________________ ______________ ______ ________
Name Title Date Phone no.

Problems; suggestions; ☐ Report attached

Agency ____________________
Contact ____________________ ______________ ______ ________
Name Title Date Phone no.

Problems; suggestions; ☐ Report attached

Agency ____________________
Contact ____________________ ______________ ______ ________
Name Title Date Phone no.

Problems; suggestions; ☐ Report attached

5. **Other interviews** (optional) ☐ Report attached.

None

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
	☒ O&M manual	☒ Readily available	☐ Up to date	☐ N/A
	☒ As-built drawings	☒ Readily available	☐ Up to date	☐ N/A
	☒ Maintenance logs	☒ Readily available	☐ Up to date	☐ N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	☒ Readily available	☒ Up to date	☐ N/A
	☒ Contingency plan/emergency response plan	☒ Readily available	☒ Up to date	☐ N/A
	Remarks: Maintained by Subcontractors.			
3.	**O&M and OSHA Training Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
	☐ Other permits	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: Gases are no longer sampled as of 2007, after previous five-year review.			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
7.	**Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A
	Remarks			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: ECC and DPW control gate access. All access to the landfill is coordinated through Troy Rosenbush or Carrie Nelson.			

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☒ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other____

2. **O&M Cost Records**

☐ Readily available ☒ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate____________________ ☐ Breakdown attached

Total annual cost by year for review period if available

From__________ (Date)	To__________ (Date)	__________________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________________ (Total cost)	☐ Breakdown attached
From__________ (Date)	To__________ (Date)	__________________ (Total cost)	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: ____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: No damaged fencing noted during site inspection.

B. Other Access Restrictions

1. **Signs and other security measures** ☒ Location shown on site map ☐ N/A

Remarks Posted signs at entry

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	☐ Yes	☒ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☒ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by): self-reporting
Frequency Monthly
Responsible party/agency U.S. Army Garrison

Contact	Alvin Char	DPW Environmental Division Chief	808-656-5790
	Name	Title	Phone no.

Reporting is up-to-date	☒ Yes	☐ No	☐ N/A
Reports are verified by the lead agency	☒ Yes	☐ No	☐ N/A
Specific requirements in deed or decision documents have been met	☒ Yes	☐ No	☐ N/A
Violations have been reported	☐ Yes	☐ No	☒ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident
Remarks: Large Equipment owned by ECC was stolen at the OU-4 Former Landfill Site over the President's Day Weekend (February 18th to 20th). No forced entry or broken fencing or gates were reported.

2. **Land use changes on site** ☐ N/A
Remarks None

3. **Land use changes off site** ☐ N/A
Remarks None

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks: Road to access MW 4-4 and the bottom of the central drainage channel is eroded and only traversable by high clearance and/or 4-wheel drive vehicles.

B. Other Site Conditions

Remarks
None

VII. LANDFILL COVERS ☒ Applicable ☐ N/A			
A. Landfill Surface			
1.	**Settlement** (Low spots) Areal extent______________ Remarks____________________	☐ Location shown on site map Depth____________	☒ Settlement not evident
2.	**Cracks** Lengths____________ Widths___________ Depths__________ Remarks: Cracks are evident during dry periods.	☐ Location shown on site map	☒ Cracking not evident
3.	**Erosion** Areal extent______________ Remarks____________________	☐ Location shown on site map Depth____________	☒ Erosion not evident
4.	**Holes** Areal extent______________ Remarks____________________	☐ Location shown on site map Depth____________	☒ Holes not evident
5.	**Vegetative Cover** ☒ Grass ☐ Trees/Shrubs (indicate size and locations on a diagram) Remarks: Vegetative cover is complete with the exception of limited barren areas near the entrance to the landfill and equipment staging areas. One tree is located on the site in the northwest portion of the landfill surface.	☒ Cover properly established	☒ No signs of stress
6.	**Alternative Cover (armored rock, concrete, etc.)** Remarks: Large boulders over a liner cover the northern sloped portion of the central drainage channel. The northern channel is also lined.	☐ N/A	
7.	**Bulges** Areal extent______________ Remarks____________________	☐ Location shown on site map Height____________	☒ Bulges not evident
8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks____________________	☒ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent______________ Areal extent______________ Areal extent______________ Areal extent______________
9.	**Slope Instability** ☐ Slides Areal extent______________ Remarks____________________	☐ Location shown on site map	☒ No evidence of slope instability
B. Benches	☒ Applicable ☐ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		

1.	**Flows Bypass Bench** ☐ Location shown on site map ☒ N/A or okay Remarks______________________________
2.	**Bench Breached** ☐ Location shown on site map ☒ N/A or okay Remarks______________________________
3.	**Bench Overtopped** ☐ Location shown on site map ☒ N/A or okay Remarks______________________________
C. Letdown Channels	☒ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)
1.	**Settlement** ☐ Location shown on site map ☒ No evidence of settlement Areal extent______________ Depth____________ Remarks______________________________
2.	**Material Degradation** ☐ Location shown on site map ☒ No evidence of degradation Material type_______________ Areal extent_____________ Remarks______________________________
3.	**Erosion** ☐ Location shown on site map ☒ No evidence of erosion Areal extent______________ Depth____________ Remarks______________________________
4.	**Undercutting** ☐ Location shown on site map ☒No evidence of undercutting Areal extent______________ Depth____________ Remarks______________________________
5.	**Obstructions** Type_____________________ ☒ No obstructions ☐ Location shown on site map Areal extent______________ Size____________ Remarks______________________________
6.	**Excessive Vegetative Growth** Type Guinea Grass and Invasive Weeds ☒ No evidence of excessive growth ☒ Vegetation in channels does not obstruct flow ☐Location shown on site map Areal extent______________ Remarks______________________________

D. Cover Penetrations ☒ Applicable ☐ N/A	
1.	**Gas Vents** ☐ Active ☒ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☒ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☒ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks: Gas Monitoring Probes are no longer sampled as of 2007.
3.	**Monitoring Wells** (within surface area of landfill) ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks: The interior of monitoring well MW 4-4 could not be accessed at the time of site inspection.
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A Remarks
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A Remarks
E. Gas Collection and Treatment ☐ Applicable ☒ N/A	
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks

F. Cover Drainage Layer ☐ Applicable ☒ N/A	
1.	**Outlet Pipes Inspected** ☐ Functioning ☐ N/A Remarks______________________________
2.	**Outlet Rock Inspected** ☐Functioning ☐N/A Remarks______________________________
G. Detention/Sedimentation Ponds ☐Applicable ☒ N/A	
1.	**Siltation** Areal extent______________ Depth____________ ☐ N/A ☐ Siltation not evident Remarks______________________________
2.	**Erosion** Areal extent______________ Depth____________ ☐ Erosion not evident Remarks______________________________
3.	**Outlet Works** ☐ Functioning ☐ N/A Remarks______________________________
4.	**Dam** ☐ Functioning ☐N/A Remarks______________________________
H. Retaining Walls ☐ Applicable ☒ N/A	
1.	**Deformations** ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement____________ Vertical displacement_______________ Rotational displacement____________ Remarks______________________________
2.	**Degradation** ☐ Location shown on site map ☐ Degradation not evident Remarks______________________________
I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐N/A	
1.	**Siltation** ☐ Location shown on site map ☒ Siltation not evident Areal extent______________ Depth____________ Remarks______________________________
2.	**Vegetative Growth** ☐ Location shown on site map ☐N/A ☒ Vegetation does not impede flow Areal extent Most of the cover Type Guinea grass, invasive weeds, trees, and shrubberies. Remarks______________________________

3.	**Erosion** ☐ Location shown on site map ☒ Erosion not evident Areal extent______________ Depth____________ Remarks____
4.	**Discharge Structure** ☒Functioning ☐ N/A Remarks____
	VIII. VERTICAL BARRIER WALLS ☐Applicable ☒N/A
1.	**Settlement** ☐ Location shown on site map ☐Settlement not evident Areal extent______________ Depth____________ Remarks____
2.	**Performance Monitoring** Type of monitoring__________________________ ☐ Performance not monitored Frequency_____________________________ ☐ Evidence of breaching Head differential__________________________ Remarks____
	IX. TREATMENT SYSTEM ☒Applicable ☐ N/A
A. System Components	
1.	**Treatment Train** (Check components that apply) ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☒ Air stripping ☐ Carbon adsorbers ☐ Filters____ ☐ Additive (*e.g.*, chelation agent, flocculent)____ ☐ Others____ ☒Good condition ☐ Needs Maintenance ☐ Sampling ports properly marked and functional ☐ Sampling/maintenance log displayed and up to date ☐ Equipment properly identified ☐ Quantity of groundwater treated annually________________________ ☐ Quantity of surface water treated annually________________________ Remarks____
2.	**Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks____
3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ☐ Good condition ☐ Proper secondary containment ☒ Needs Maintenance Remarks: Brackets at base of air stripping towers at the Schofield Barracks Water Treatment Plant are heavily corroded.
4.	**Discharge Structure and Appurtenances** ☒ N/A ☐ Good condition ☐ Needs Maintenance Remarks____

5. **Treatment Building(s)**
☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair
☒ Chemicals and equipment properly stored
Remarks____

6. **Monitoring Wells** (pump and treatment remedy)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks____

B. Monitoring Data

1. Monitoring Data
☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

C. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A
Remarks____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

None

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Remedy appears to be functioning as intended and in good working order with the exception of the Water Treatment Plant corrosion noted above. Recent rains have resulted in good vegetation on landfill cover with few isolated bare spots. No cracks or erosion were noted at time of site inspection.

B.	Adequacy of O&M
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Replace air stripper tower brackets at the Schofield Water Treatment Plant. Maintain overgrowth of vegetation and seed/plant bare spots. Remedies are functioning as intended.
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. None at this time.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None at this time.

Table F.3: Supplemental Operational History Questionnaire for the Schofield Barracks Water Treatment Plant

Question	Response
1) What was the overall system uptime or downtime information for at least the last three years?	1) Deep Well #1 down for cla-valve over-haul. Dec 2009 - Feb 2010 Order parts and over-haul valve. 2) March 2010 lost main transformer. On generator power (Prime Power Military Support) 2-1/2 weeks. 3) Deep Well (DW #4) Down April 2010 - Sept 2010 Replacement of motor starters 4) Deep Well (DW #3) Down Sept 2010 - Mar 2011 Replacement of motor starter 5) Deep Well (DW #2) Down Mar 2011 - Jul 2011 Replacement of motor starter f. Deep Well (DW #3) Aug 2011 motor burned. Still not repaired elevator car not fixed. 6) Deep well (DW #4) Oct 2011 Off line due to High current draw. Not repaired. Due to elevator car not fixed.
2) What were the primary reasons for system downtime (e.g., some type of alarm shutdown condition, power outages, equipment failure) and corrective measures taken?	1) Down starter motor-replacement of motor starters 2) The elevator car not fixed-plans made to fix the car 3) Lost main transformer-used generator power support
3) Were any other required major equipment repairs or replacements completed or planned?	When the elevator car is fixed motors will be removed and inspected. (DW #2 & DW #4)
4) What are other significant maintenance requirements or needs (e.g., iron or calcium scaling or biofouling requiring sequestering or biocide agents)?	None was required
5) How frequently is acid or other back-flushing of the packing performed and what are the methods/chemicals used?	Backwashing of the Air Stripping Towers are done once in five weeks with 10 ppm sodium hypochlorite solution mixed with water.

6) When was the last time the tower packing required replacement?	The tower packing has not been replaced. Tower #3 was inspected November 2011
7) Has there been a stripper replacement in any towers? If yes, a) what was the date of the replacement? b) What if any equipment was replaced? c) Was there any down time associated with the replacement? If no, was the stripper inspected and was there down time associated with the inspection?	No equipment or stripper was replaced in the past 5 years. An inspection of the condition of the packing was conducted in March 2012. No down time was required for the inspection since it was conducted in two towers that were out service during routine weekly rotation.
8) Any significant modifications to treatment system equipment, operating parameters, or O&M procedures over the last 5 years and if so what are the reasons (Any informal or formal system reviews and/or optimization protocol should also be included.)?	There are plans to do a study to bring deep well pumps above ground in 2015/2016.

Appendix G

TIME VERSUS CONCENTRATION GRAPHS FOR LANDFILL GAS DATA

Figure G1: Historical Methane Concentrations for Landfill Gas Monitoring Probes
(11 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii

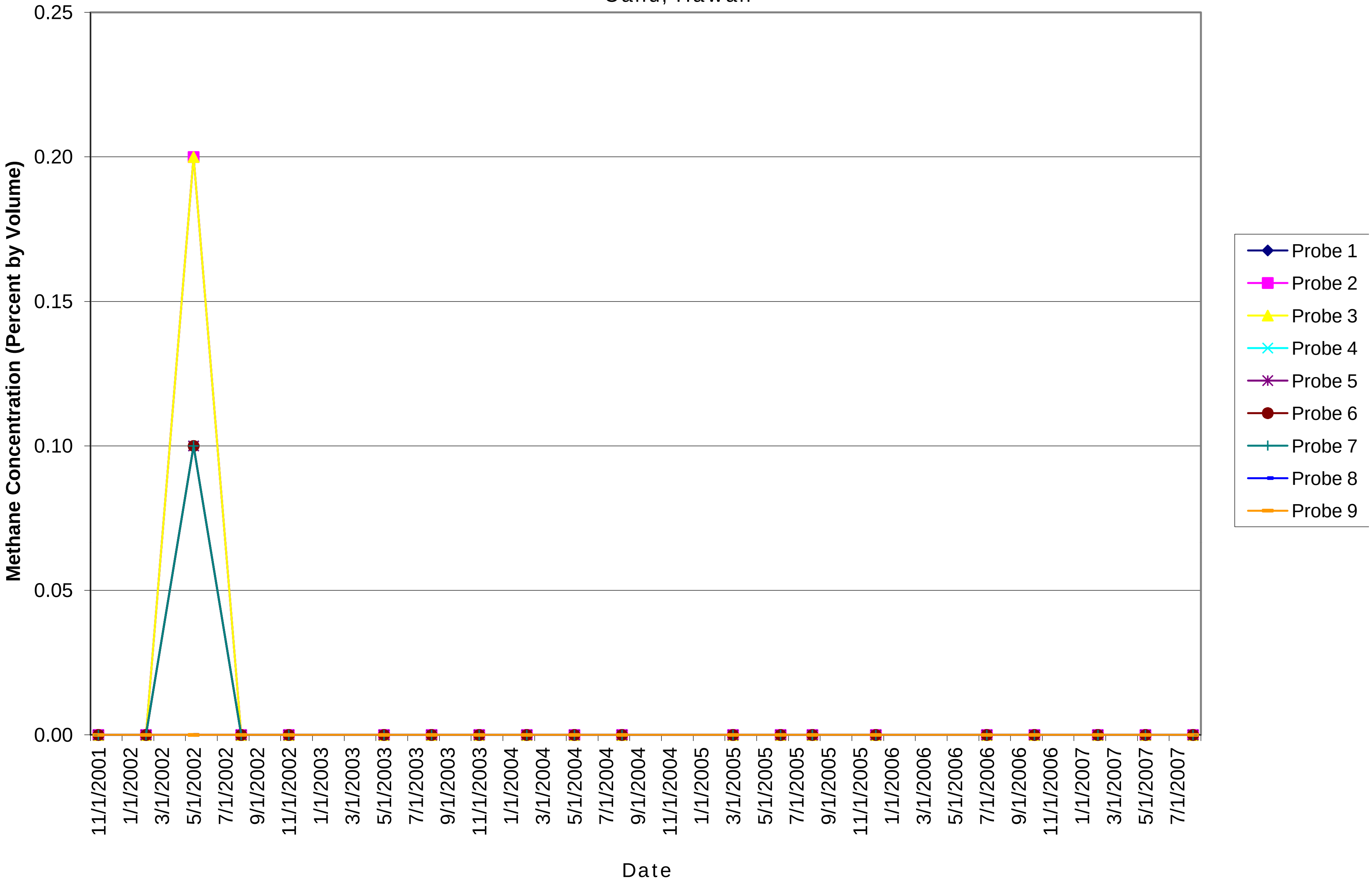


Figure G2: Historical Methane Concentrations for Landfill Gas Monitoring Probes
(24 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii

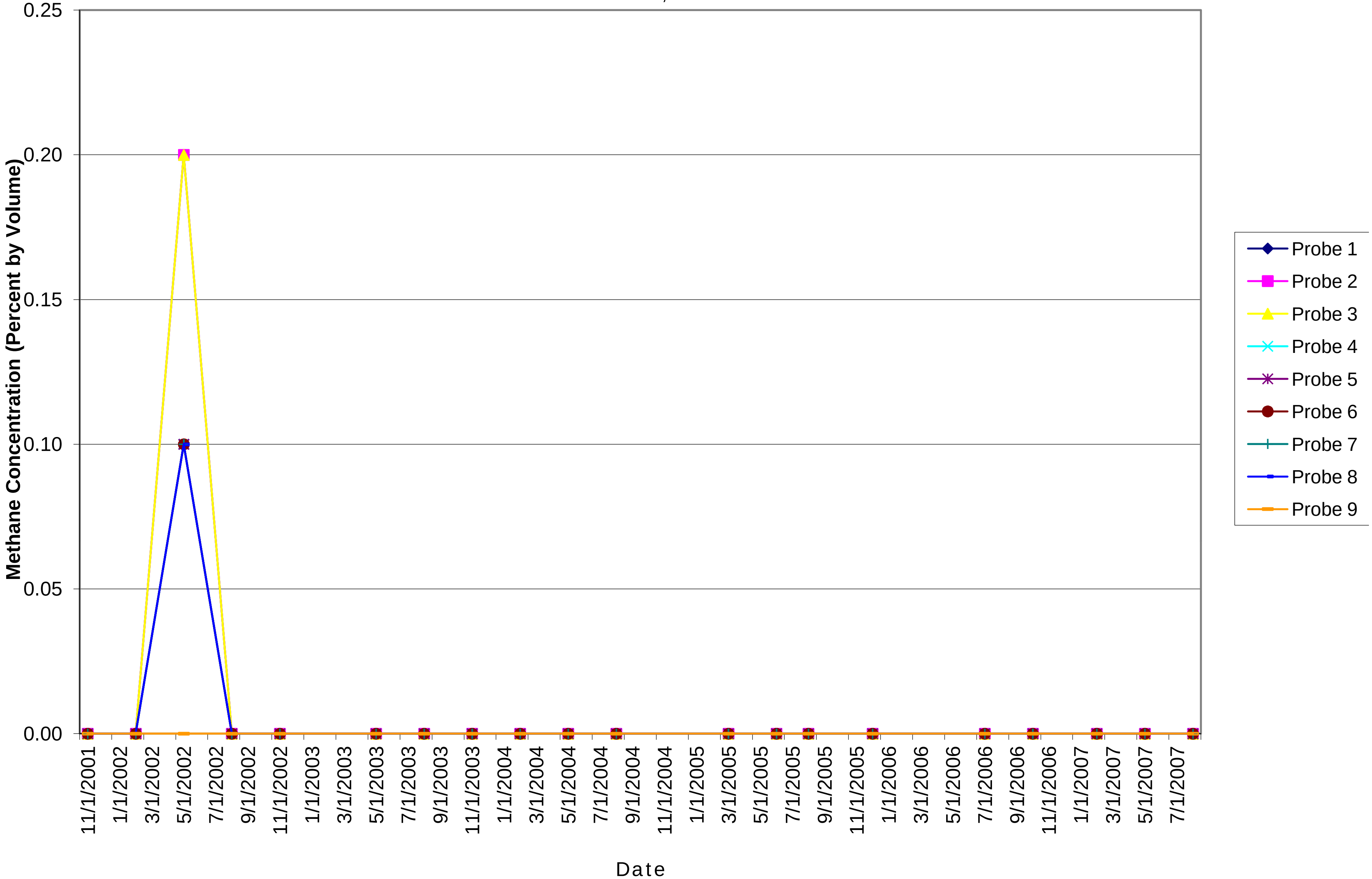


Figure G3: Historical Methane Concentrations for Landfill Gas Monitoring Probes
(37 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii

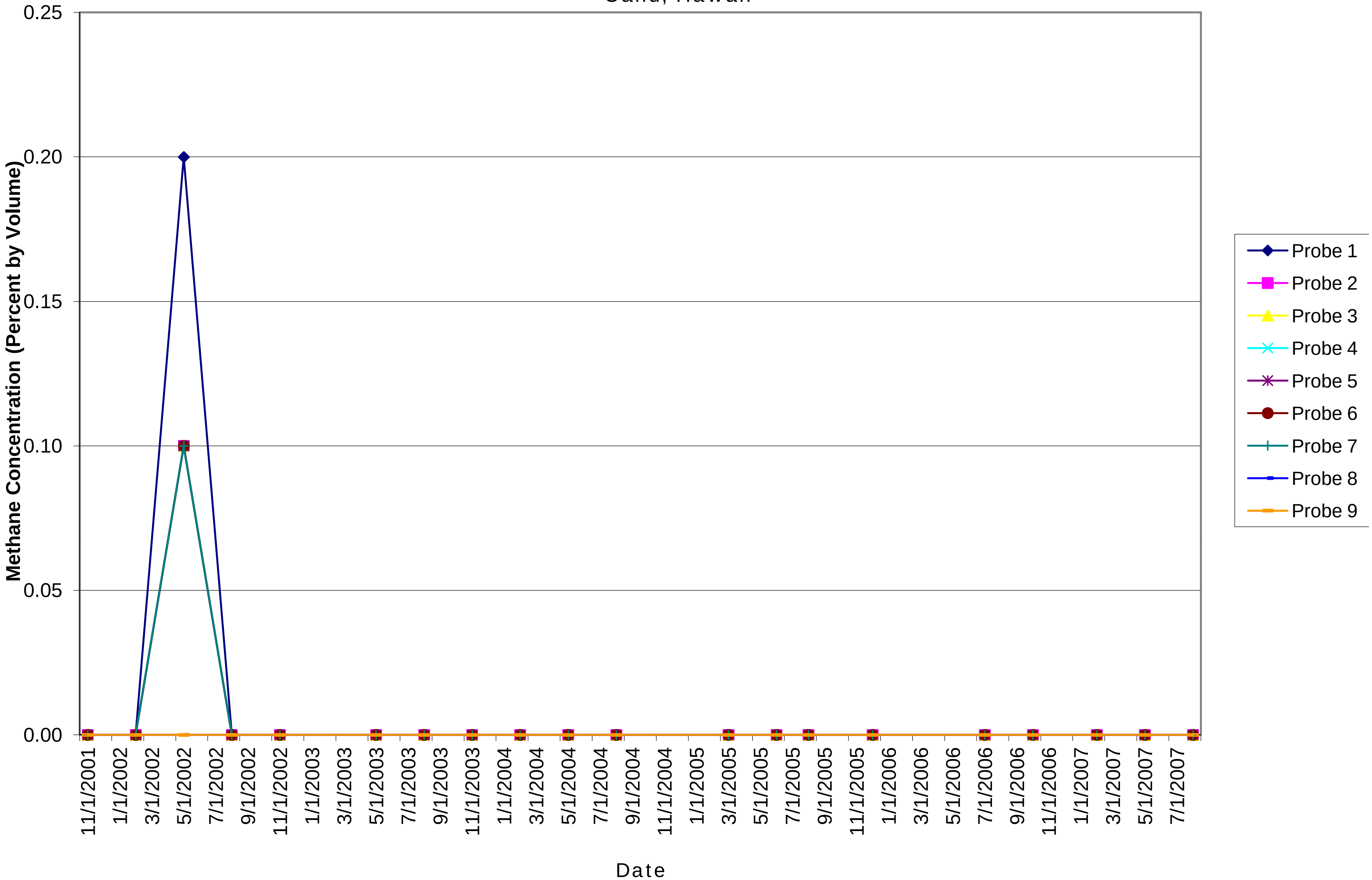


Figure G4: Historical Oxygen Concentrations for Landfill Gas Monitoring Probes
(11 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii

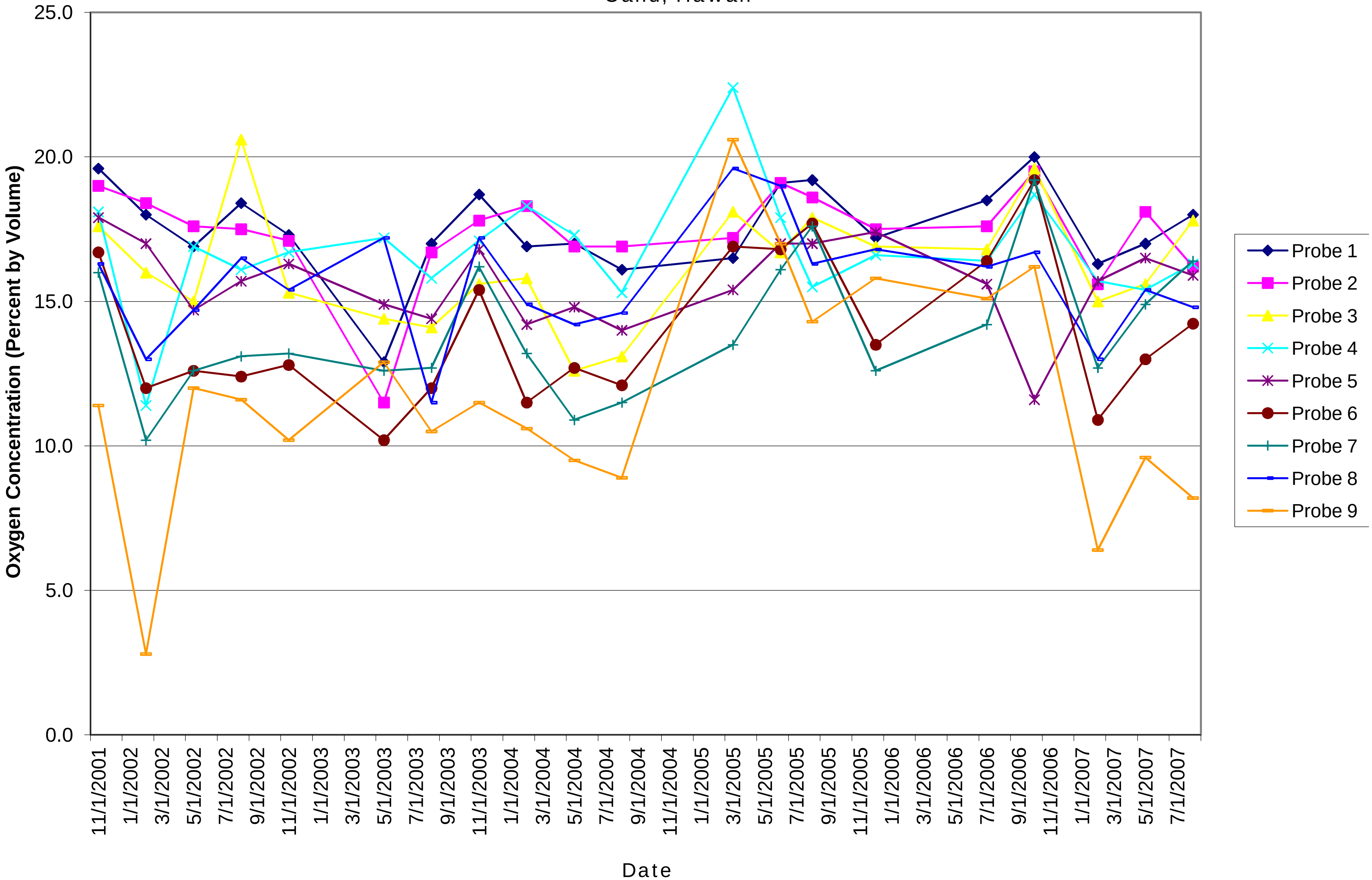
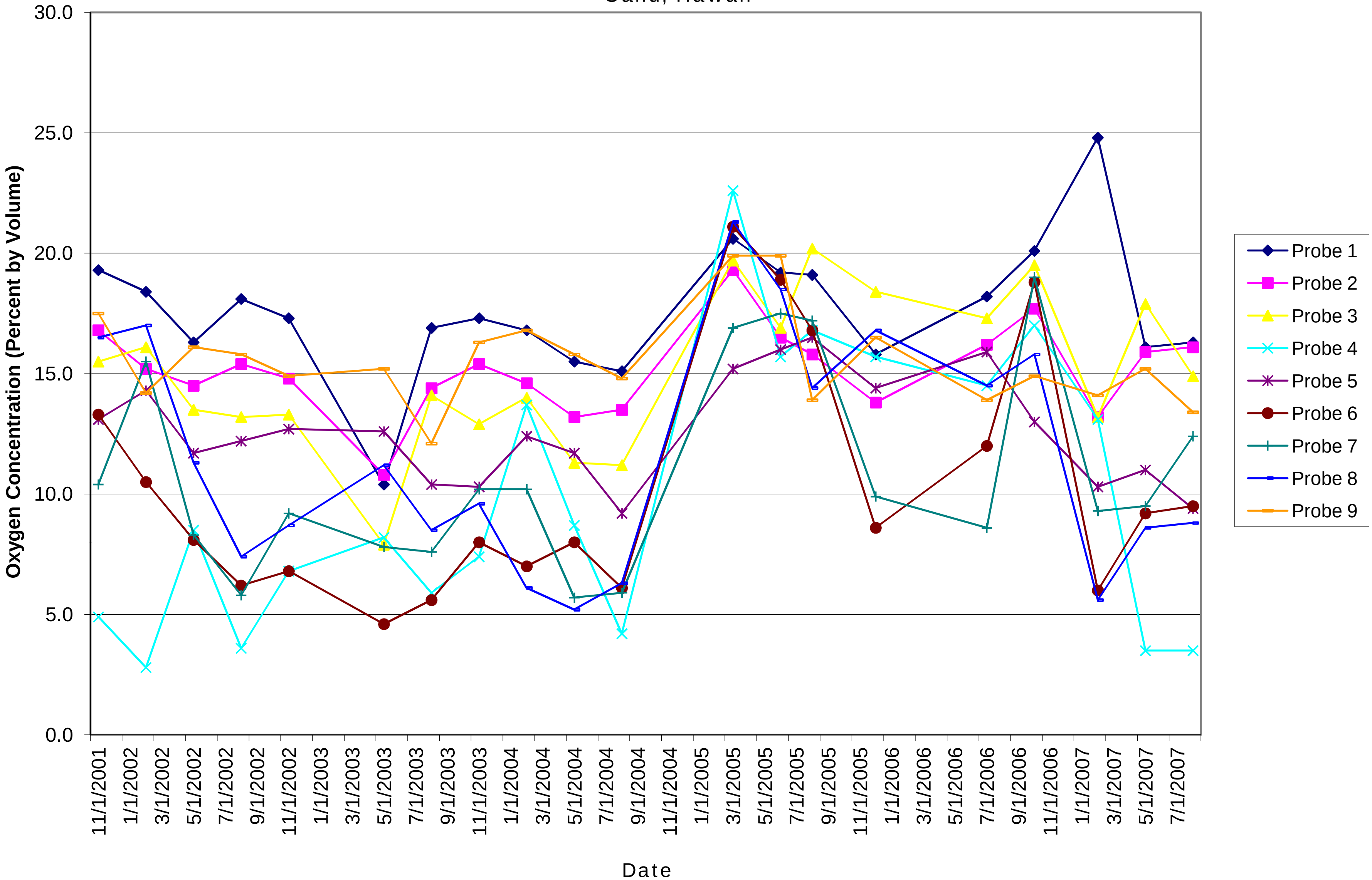


Figure G5: Historical Oxygen Concentrations for Landfill Gas Monitoring Probes
(24 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii



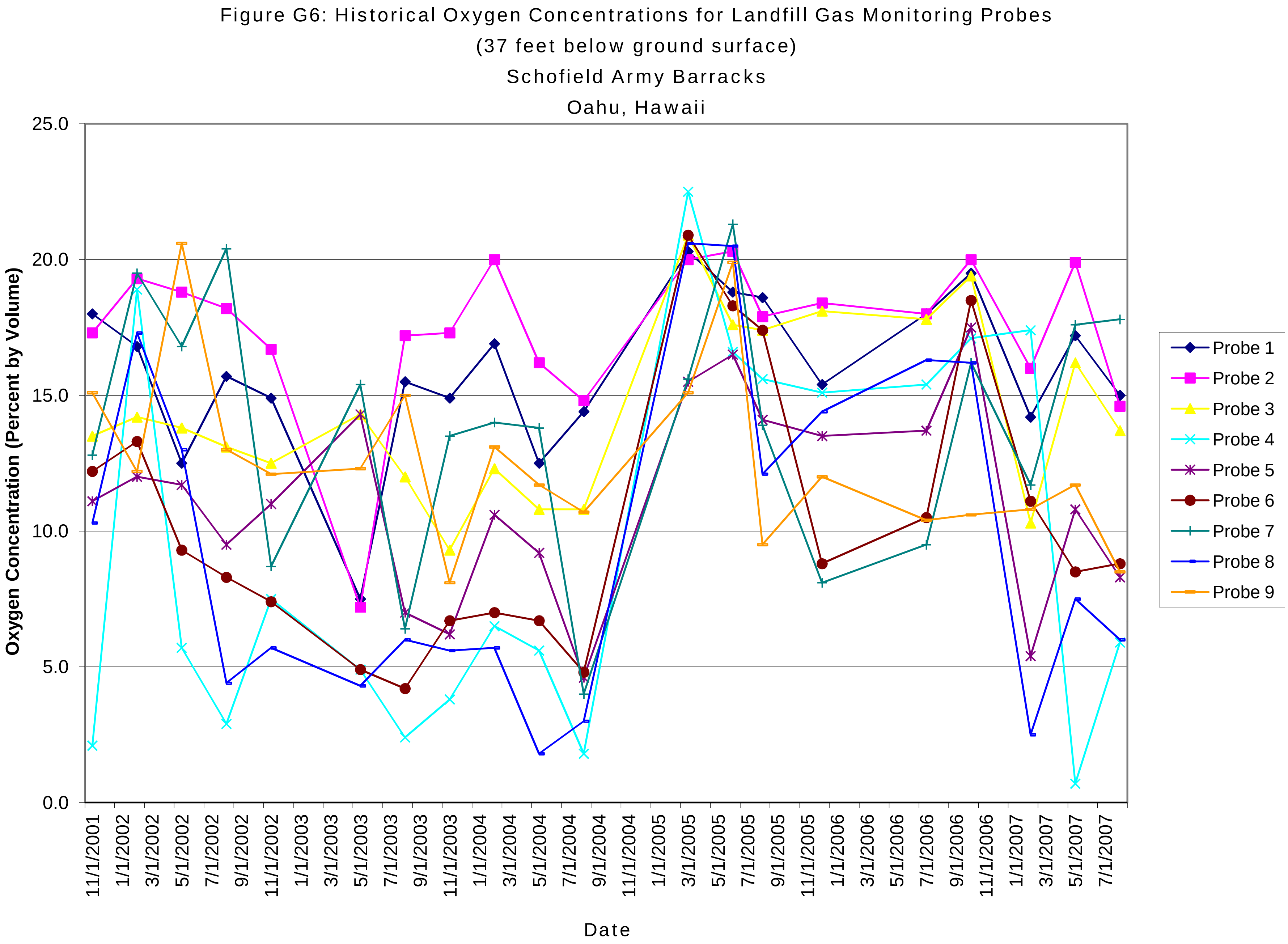


Figure G6: Historical Oxygen Concentrations for Landfill Gas Monitoring Probes
(37 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii
Oxygen Concentration (Percent by Volume)
25.0
20.0
15.0
10.0
5.0
0.0
11/1/2001
1/1/2002
3/1/2002
5/1/2002
7/1/2002
9/1/2002
11/1/2002
1/1/2003
3/1/2003
5/1/2003
7/1/2003
9/1/2003
11/1/2003
1/1/2004
3/1/2004
5/1/2004
7/1/2004
9/1/2004
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7/1/2005
9/1/2005
11/1/2005
1/1/2006
3/1/2006
5/1/2006
7/1/2006
9/1/2006
11/1/2006
1/1/2007
3/1/2007
5/1/2007
7/1/2007
Date
Probe 1
Probe 2
Probe 3
Probe 4
Probe 5
Probe 6
Probe 7
Probe 8
Probe 9

Figure G7: Historical Carbon Dioxide Concentrations for Landfill Gas Monitoring Probes
(11 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii

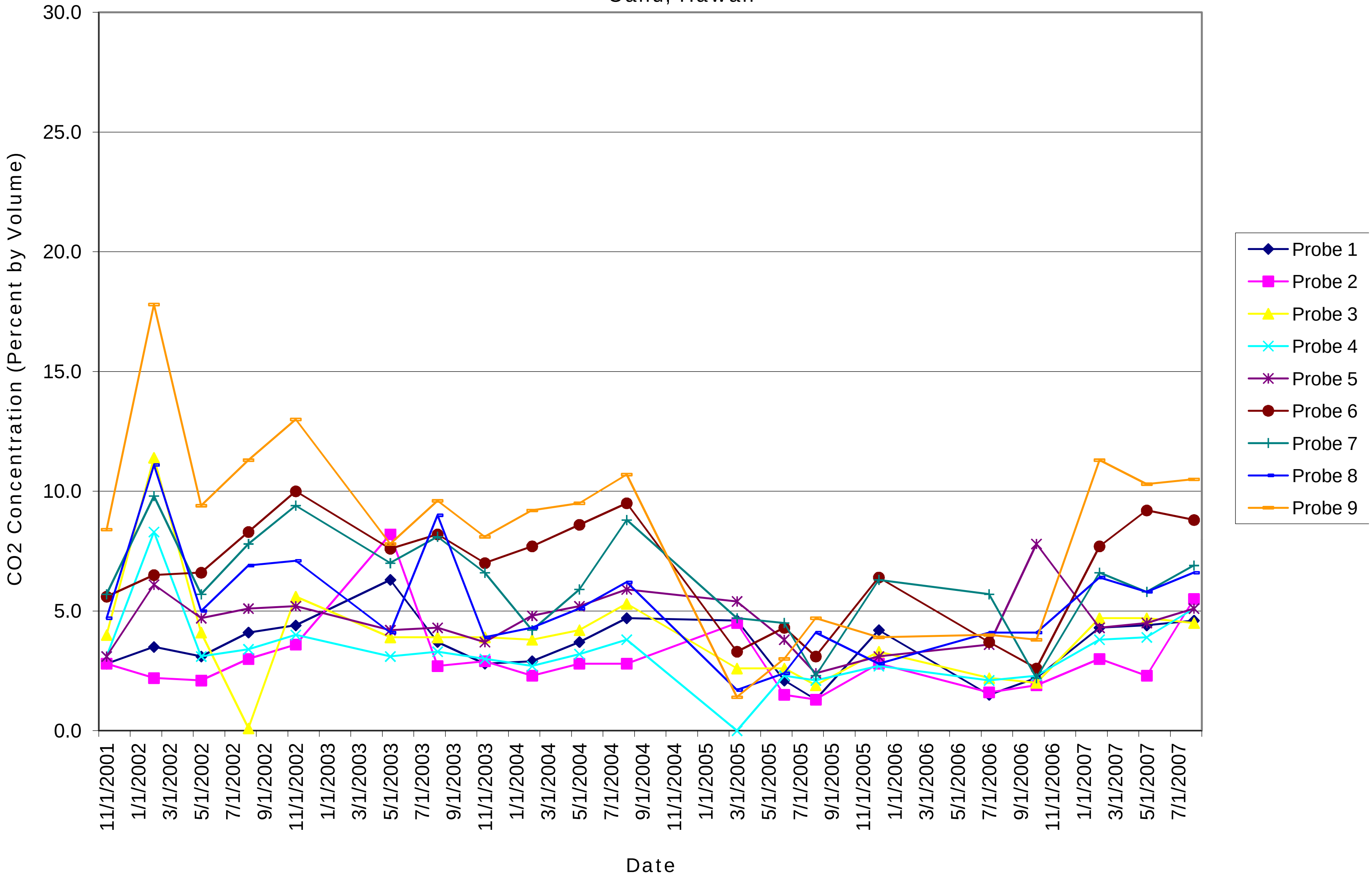


Figure G8: Historical Carbon Dioxide Concentrations for Landfill Gas Monitoring Probes
(24 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii

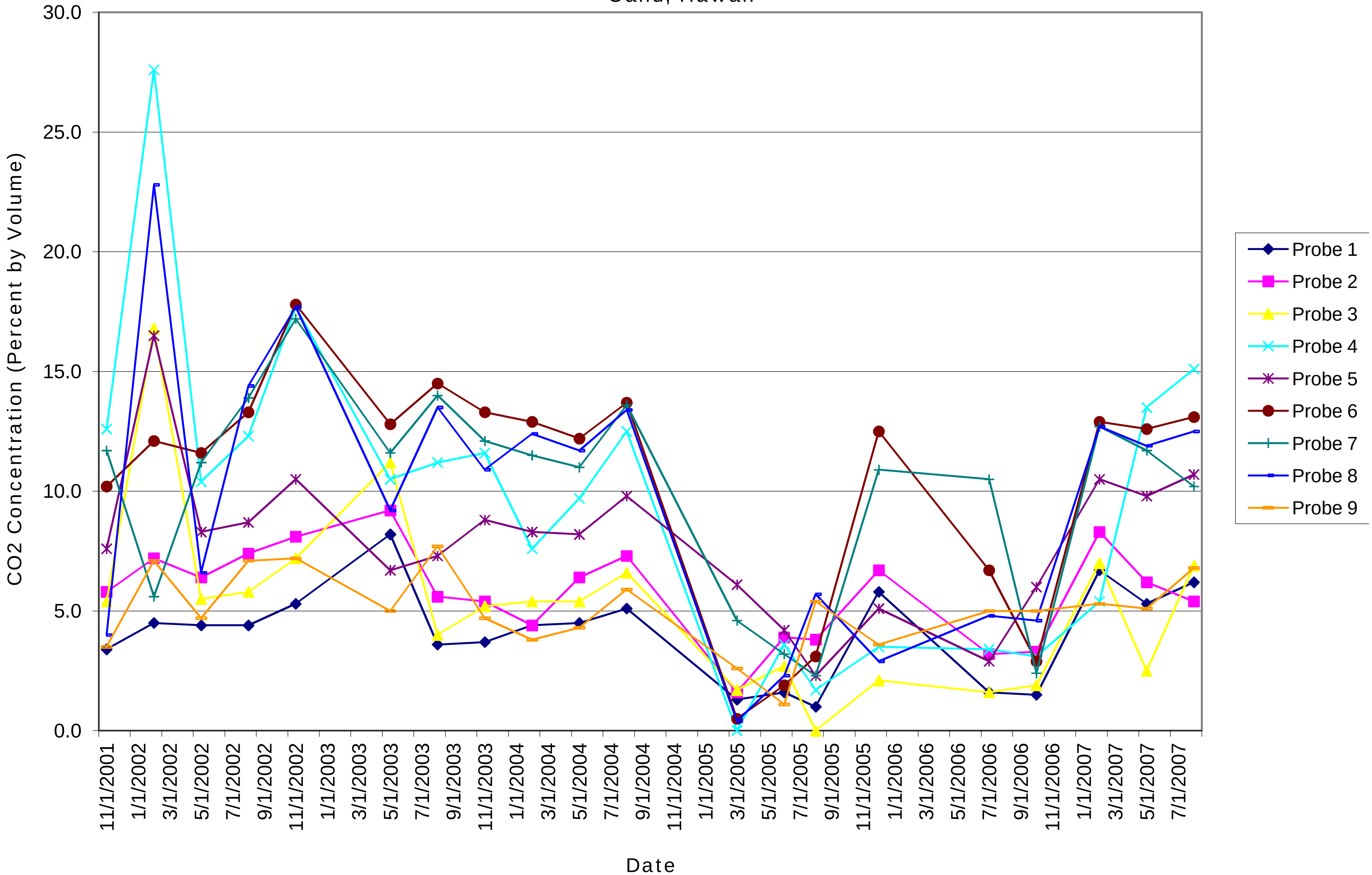
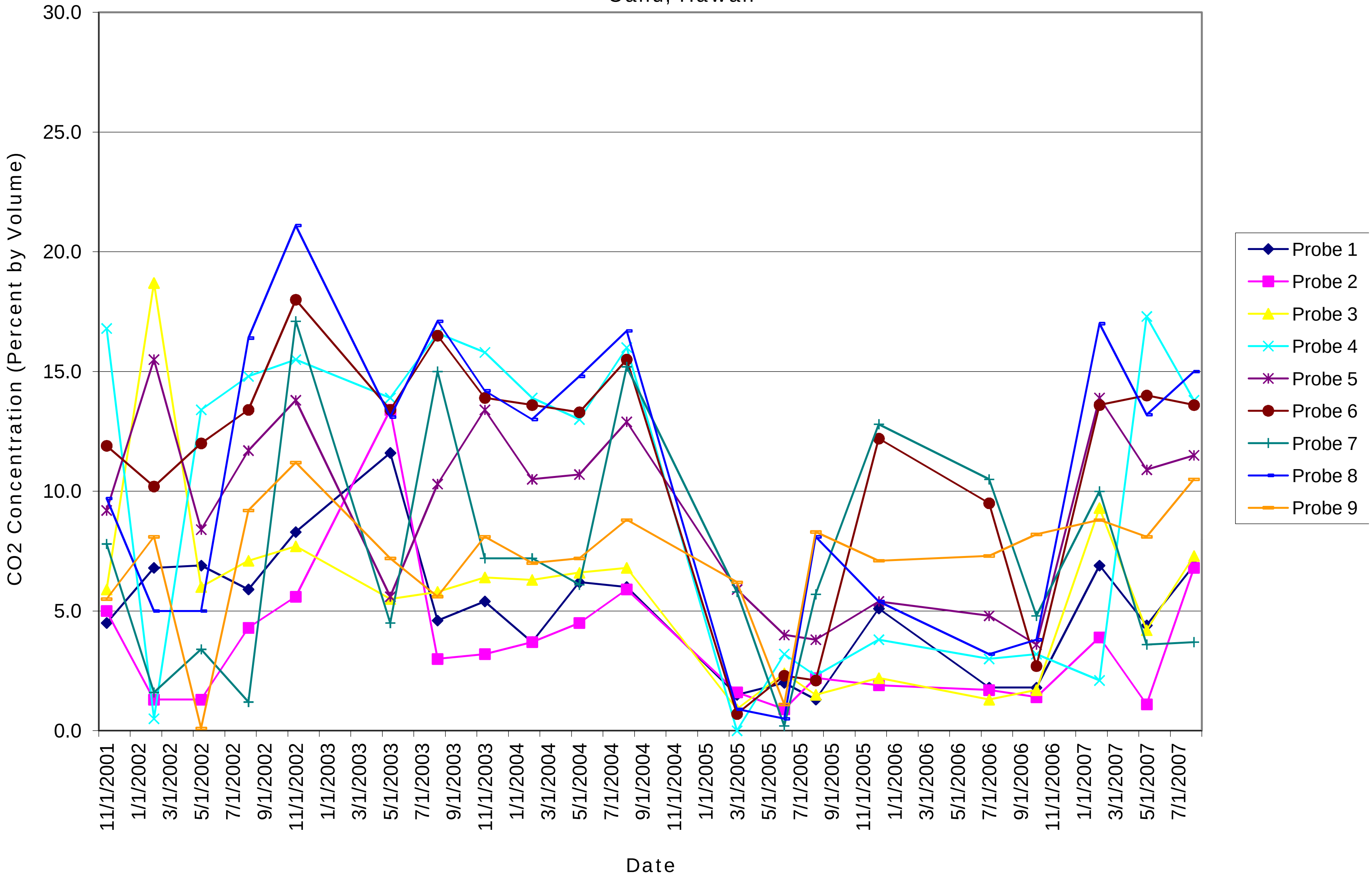


Figure G9: Historical Carbon Dioxide Concentrations for Landfill Gas Monitoring Probes
(37 feet below ground surface)
Schofield Army Barracks
Oahu, Hawaii



Appendix H

LONG-TERM MONITORING REPORTS, JANUARY 2007 TO DECEMBER 2011

Provided on Compact Disc

Appendix I

SITE INSPECTION PHOTOGRAPHS

Photo 1

Del Monte Air Stripper at Kunia Village Operable Unit 2.

Photo 2

Del Monte - Air Blower Motor, will need to be replaced in the next 2-3 years.

W.O.	4663070005	Schofield Army Barracks Five-Year Review U.S. Army Environmental Command
PROCESSED	HM	
DATE	March 2012	Directorate of Public Works United States Army Garrison, Hawaii
		PHOTOGRAPH LOG

Photo 3

Del Monte – Air Blower Gasket, gasket and rubber manifold for air blower scheduled to be replaced the week of 26 March 2012.

Photo 4

Del Monte – Generator.

W.O.	4663070005
PROCESSED	HM
DATE	March 2012

Schofield Army Barracks Five-Year Review
U.S. Army Environmental Command

Directorate of Public Works
United States Army Garrison, Hawaii

PHOTOGRAPH LOG

Photo 5

Del Monte – Access gate.

Photo 6

Schofield Barracks WTP – Rusting of stripping tower brackets.

Photo 7

Schofield Barracks WTP – Air Blower Unit.

Photo 8

Schofield Barracks WTP – Rusting of stripping tower brackets.

Photo 9

Schofield Barracks WTP – Rusting of stripping tower brackets.

Photo 10

Schofield Barracks WTP – Sump Pumps.

Photo 11

Sandwich Isles Communications Field Site Air Stripping System. Waipio Acres, Oahu, Hawaii.

Photo 12

SIC Air Stripping System perimeter fencing and signage.

Photo 13

SIC Air Stripping System – system generator

Photo 14

SIC Air Stripping System – pressure gauge tubing malfunction

Photo 15

SIC Air Stripping System – preliminary signs of rusting on stripping tower brackets

Photo 16

SIC Air Stripping System – corrosion on holding tank valve

Photo 17

Schofield Barracks
Former Landfill Site,
Operable Unit 4

Photo 18

Schofield Barracks
Former Landfill Site –
Access Gate.

W.O.	4663070005
PROCESSED	HM
DATE	March 2012

Schofield Army Barracks Five-Year Review
U.S. Army Environmental Command

Directorate of Public Works
United States Army Garrison, Hawaii

PHOTOGRAPH LOG

Photo 19

Schofield Barracks Former Landfill southern perimeter fencing. Limited barren areas near landfill entrance and equipment staging area.

Photo 20

Schofield Barracks Former Landfill Central Drainage Channel.

Photo 21

Schofield Barracks Former Landfill soil stockpile.

Photo 22

Schofield Barracks Former Landfill vegetation.

Photo 23

Schofield Barracks
Former Landfill
sprinkler system.

Photo 24

Schofield Barracks
Former Landfill
moisture sensor.

Photo 25

Schofield Barracks Former Landfill gas probe. Gas probes at the site are no longer used.

Photo 26

Schofield Barracks Former Landfill access road to bottom of central drainage channel. Road shows signs of erosion and disrepair.

Photo 27

Schofield Barracks Former Landfill Site – Northern Drainage Channel.

Photo 28

Schofield Barracks Former Landfill Site - tree located on site.

Photo 29

Groundwater Monitoring Well MW 1-1

Photo 30

MW 1-1 Interior

Photo 31

Groundwater Monitoring Well MW 2-1

Photo 32

MW 2-1 - Damaged southwest bollard.

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DATE March 2012

Schofield Army Barracks Five-Year Review
U.S. Army Environmental Command

Directorate of Public Works
United States Army Garrison, Hawaii

PHOTOGRAPH LOG

Photo 33

MW 2-1 – Damaged northwest bollard, leans inward.

Photo 34

MW 2-1 – Interior, monitoring well vent covered only by PVC pipe wrap.

Photo 35

Groundwater Monitoring Well MW 2-2. No Access

Photo 36

MW 2-2. No Access

Photo 37

Groundwater Monitoring Well MW 2-3.

Photo 38

MW 2-3 Interior.

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PROCESSED	HM	
DATE	March 2012	Directorate of Public Works United States Army Garrison, Hawaii PHOTOGRAPH LOG

Photo 39

Groundwater Monitoring Well MW 2-4.

Photo 40

MW 2-4 Interior.

Photo 41

Groundwater
Monitoring Well MW 2-5

Photo 42

MW 2-5 Interior

Photo 43

MW 2-5 – Bent lid catch. Well was not secure at time of inspection.

Photo 44

MW 2-5 – Access road conditions. Range Control arranged to have the tree removed on 31 March 2012. 4X4 vehicle still needed to access well.

Photo 45

Groundwater Monitoring Well MW 2-6

Photo 46

MW 2-6 Interior

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DATE	March 2012

Schofield Army Barracks Five-Year Review
U.S. Army Environmental Command

Directorate of Public Works
United States Army Garrison, Hawaii

PHOTOGRAPH LOG

Photo 47

MW 2-6 – Bent monitoring well lid hook. Apparatus is still functional and monitoring well can be secured with padlock.

Photo 48

Groundwater Monitoring Well MW 4-1.

Photo 49

MW 4-1 Interior – missing cap.

Photo 50

Groundwater Monitoring Well MW 4-2A.

Photo 51

MW 4-2A Interior

Photo 52

Groundwater monitoring well MW 4-3 – Padlock could not be opened with given combination at time of inspection

Photo 53

MW 4-3 Interior

Photo 54

MW 4-3 bent lid catch. Well was not secure at time of inspection.

Photo 55

Groundwater Monitoring Well MW 4-4.

Photo 56

MW 4-4 - Interior could not be accessed at time of field inspection. Padlock could not be opened with given combination.

W.O.	4663070005	Schofield Army Barracks Five-Year Review U.S. Army Environmental Command
PROCESSED	HM	Directorate of Public Works United States Army Garrison, Hawaii
DATE	March 2012	PHOTOGRAPH LOG

Appendix J

COMMUNITY RELATIONS ACTIVITIES

5-Year Review Stakeholders for 2012

Roger Babcock
Water Resource Research Center
Holmes Hall 283
Univerity of Hawaii at Manoa
2540 Dole St.
Honolulu, HI. 96822

Josie Bidgood
Vice President and Manager
Bank of Hawaii
Trust Real Estate and Closely Held Group, #722
PO Box 3170
Honolulu, HI. 96802-3170

Mike Fitzgerald
NAVFAC Hawaii
400 Marshall Road
Code OPHP 611
Joint Base Pearl Harbor-Hickam, HI. 96860

Charles Hunt
US Geological Survey
Pacific Islands Water Science Center
677 Ala Moana Blvd., Ste. 415
2540 Dole St.
Honolulu, HI. 96813

Rodney Kaulupali
Sandwish Isles Communication
1003 Bishop Street, Suite 2700
Honolulu, HI 96813

Clifford P. Lum
Board of Water Supply
City & County of Honolulu
630 S. Beretania St.
Honolulu, HI. 96843

Karen Maddox
Hawaii Country Club
PO Box 861634
Wahiawa, HI. 96786

Jocelyn Tamashiro
NAVFAC Hawaii
75 H St., Bldg. 1202
Hickam AFB, HI. 96853-5233

Gary Paracuelles
Dole Food Company Hawaii
1116 Whitmore Ave.
Wahiawa, HI. 96786

Dean Y. Watanabe
Navy Information Operations Command Hawaii
Bldg., 9, Code N4 Facilities
Schofield Barracks, HI. 96857-5300

Stephanie A. Whalen
Hawaii Agriculture Research Center
PO Box 100
Kunia, HI. 96759

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
Public Notice

STATE OF HAWAII } SS.
City and County of Honolulu

Doc. Date: MAY 1 6 2012	**# Pages:** 1
Notary Name: PATRICIA K. REESE	FIRST JUDICIAL **Circuit**
Doc. Description: AFFIDAVIT OF PUBLICATION	
Notary Signature MAY 1 6 2012	Date

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 88-467 STATE OF HAWAII

Cyd Kamakea being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser and MidWeek, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser 3 times on:

05/13, 05/14, 05/15/2012

Midweek Wed. 0 times on:

_____________ times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Cyd Kamakea

Subscribed to and sworn before me this 16th day

of MAY A.D. 20 12

Notary Public of the First Judicial Circuit, State of Hawaii

My commission expires:

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 88-467 STATE OF HAWAII

Ad # 0000415898

LN:________

Public Notice Public Notice Public Notice

Public Notice

The U.S. Army Garrison, Hawaii (USAG-HI) has prepared its annual Draft Five-Year Review Report regarding long-term monitoring of Operable Units (OUs) 2 and 4 at Schofield Barracks. These OUs were previously established to address potential areas of environmental concern. OU-2 focuses on groundwater beneath Schofield Barracks and surrounding areas, and OU-4 focuses on a former military landfill at Schofield Barracks. The environmental remedies that were implemented include monitoring of groundwater from OU-2 and OU-4, groundwater treatment at selected wellheads, and maintenance of a landfill cap at OU-4.

The Draft Five-Year Review Report was prepared in accordance with the 1996 OU-2 and OU-4 Records of Decision; the Comprehensive Environmental Response, Compensation, and Liability Action of 1980 (CERCLA); the National Contingency Plan (NCP); and the Comprehensive Five-Year Review Guidance Document (U.S. Environmental Protection Agency [EPA], 2001).

The Army will hold a 30-day public comment period for this Draft Five-Year Review Report from May 16, 2012, to June 15, 2012. The report may be viewed at the Mililani Public Library, 95-450 Makaimoimo St., Mililani, Hawaii 96789; and the Wahiawa Public Library, 820 California Ave., Wahiawa, Hawaii, 96786.

Please provide comment(s) during the public comment period to:

Ms. Carrie Nelson
USAG-HI Directorate of Public Works (DPW)
948 Santos Dumont
Building 105, 3rd Floor, Wheeler Army Airfield
Schofield Barracks, Hawaii 96857-5013.
(808) 656-3092

(SA415898 5/13, 5/14, 5/15/12)

IN THE MATTER OF

PUBLIC NOTICE

PUBLIC NOTICE

USAG-HI Solicits Interest to Establish Restoration Advisory Boards for Kunia Field Station, Schofield Army Barracks and Tripler Army Medical Center

The U.S. Army Garrison, Hawaii (USAG-HI) is soliciting the public for interest in establishing three separate Restoration Advisory Boards (RABs) for Kunia Field Station, Schofield Army Barracks, and Tripler Army Medical Center, Oahu, Hawaii. The purpose of a RAB is to promote community involvement by giving the public the opportunity to regularly review progress and participate in dialogue with the decision-makers on the environmental restoration process at these installations.

The Army is required to solicit the public every two years for interest in establishing RABs at these installations. If you are interested in participating in a RAB for any of the three installations listed, please contact Joel Narusawa at USAG-HI Directorate of Public Works, (808) 656-3089.

(Hon. Adv.: Aug. 10, 11, 12, 2008) (A-532855)

STATE OF HAWAII
City and County of Honolulu

AFFIDAVIT OF PUBLICATION

ss.

Jane Kawasaki being duly sworn deposes and says that she is a clerk, duly authorized to execute this affidavit of THE HONOLULU ADVERTISER, a division of GANNETT PACIFIC CORPORATION, that said newspaper is a newspaper of general circulation in the State of Hawaii, and that the attached notice is a true notice as was published in the aforereferenced newspaper as follows

08/10/2008	The Honolulu Advertiser
08/11/2008	The Honolulu Advertiser
08/12/2008	The Honolulu Advertiser

and that affiant is not a party to or in any way interested in the above entitled matter.

Jane Kawasaki

Subscribed and sworn to before me this 12th day of August A.D. 2008

JEANETTE T. CHING
NOTARY PUBLIC
STATE OF HAWAII

Notary Public of the First Judicial Circuit
State of Hawaii
My Commission Expires: June 16, 2010

IN THE MATTER OF }
Public Notice } *AFFIDAVIT OF PUBLICATION*

STATE OF HAWAII } SS.
City and County of Honolulu }

Doc. Date: AUGUST 12, 2008 **# Pages:** 1
Notary Name: Patricia K. Reese First Judicial **Circuit**
Doc. Description: Affidavit of Publication

Patricia K. Reese 08/12/08
Notary Signature Date

Rose Mae Rosales being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of MidWeek Printing, Inc. publisher of MidWeek and the Honolulu Star-Bulletin, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Bulletin 3 times on:
08/10, 08/11, 08/12/2008

Midweek Wed. 0 times on:

Midweek Fri. 0 times on:

______ times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Rose Mae Rosales

Subscribed to and sworn before me this 12th day
of August A.D. 20 08

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: October 07, 2010

Ad # 0000056937

PUBLIC NOTICE

USAG-HI Solicits Interest to Establish Restoration Advisory Boards for Kunia Field Station, Schofield Army Barracks and Tripler Army Medical Center

The U.S. Army Garrison, Hawaii (USAG-HI) is soliciting the public for interest in establishing three separate Restoration Advisory Boards (RABs) for Kunia Field Station, Schofield Army Barracks and Tripler Army Medical Center, Oahu, Hawaii. The purpose of a RAB is to promote community involvement by giving the public the opportunity to regularly review progress and participate in dialogue with the decision-makers on the environmental restoration process at these installations.

The Army is required to solicit the public every two years for interest in establishing RABs at these installations. If you are interested in participating in a RAB for any of the three installations listed, please contact Joel Narusawa at USAG-HI Directorate of Public Works, (808) 656-3089.
(SB56937 8/10, 8/11, 8/12/08)

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

LN: ________

IN THE MATTER OF

Public Notice

AFFIDAVIT OF PUBLICATION

STATE OF HAWAII } SS.
City and County of Honolulu

Doc. Date: APR 1 3 2010 **# Pages:** 1

Notary Name: Patricia K. Reese First Judicial **Circuit**

Doc. Description: Affidavit of Publication

APR 1 3 2010

Notary Signature Date

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

Rose Mae Rosales being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidiavit of MidWeek Printing, Inc. publisher of MidWeek and the Honolulu Star-Bulletin, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Bulletin 3 times on:
04/11, 04/12, 04/13/2010

Midweek Wed. 0 times on:

Midweek Fri. 0 times on:

_______ times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Rose Mae Rosales

Subscribed to and sworn before me this 13th day

of April A.D. 2010

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii

My commission expires: October 07, 2010

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

Ad # 0000185441

LN:________

PUBLIC NOTICE

USAG-HI Solicits Interest in Establishing Restoration Advisory Boards for Kunia Field Station, Schofield Barracks and Tripler Army Medical Center

The U.S. Army Garrison, Hawaii (USAG-HI) is soliciting the public for interest in establishing three separate Restoration Advisory Boards (RABs) for Kunia Field Station, Schofield Barracks and Tripler Army Medical Center, Oahu, Hawaii. The purpose of a RAB is to promote community involvement by giving the public the opportunity to regularly review progress, and participate in dialogue with the decision-makers, on the environmental restoration process at these installations.

The Army is required to solicit the public every two years for interest in establishing RABs at these installations. If you would like more information or are interested in participating in a RAB for any of the three installations listed, please contact Carrie Nelson, USAG-HI Directorate of Public Works, at (808) 656-3106.
(SB185441 4/11, 4/12, 4/13/10)

IN THE MATTER OF

PUBLIC NOTICE

PUBLIC NOTICE

USAG-HI Solicits Interest in Establishing Restoration Advisory Boards for Kunia Field Station, Schofield Barracks and Tripler Army Medical Center

The U.S. Army Garrison, Hawaii (USAG-HI) is soliciting the public for interest in establishing three separate Restoration Advisory Boards (RABs) for Kunia Field Station, Schofield Barracks and Tripler Army Medical Center, Oahu, Hawaii. The purpose of a RAB is to promote community involvement by giving the public the opportunity to regularly review progress, and participate in dialogue with the decision-makers, on the environmental restoration process at these installations.

The Army is required to solicit the public every two years for interest in establishing RABs at these installations. If you would like more information or are interested in participating in a RAB for any of the three installations listed, please contact Carrie Nelson, USAG-HI Directorate of Public Works, at (808) 656-3106.

(Hon. Adv.: Apr. 11, 12, 13, 2010) (A-804453)

AFFIDAVIT OF PUBLICATION

STATE OF HAWAII
City and County of Honolulu

ss.

Grace Santos being duly sworn deposes and says that she is a clerk, duly authorized to execute this affidavit of THE HONOLULU ADVERTISER, a division of GANNETT PACIFIC CORPORATION, that said newspaper is a newspaper of general circulation in the State of Hawaii, and that the attached notice is a true notice as was published in the aforereferenced newspaper as follows

04/11/2010 The Honolulu Advertiser
04/12/2010 The Honolulu Advertiser
04/13/2010 The Honolulu Advertiser

and that affiant is not a party to or in any way interested in the above entitled matter.

Grace Santos

Subscribed and sworn to before me this 13th day of April A.D. 2010

ELSIE A. MARUYAMA NOTARY 88-127 PUBLIC STATE OF HAWAII

Elsie A. Maruyama
Notary Public of the First Judicial Circuit
State of Hawaii
My commission expires March 7, 2012

NOTARY PUBLIC CERTIFICATION

Elsie A. Maruyama First Judicial Circuit

Document Description: Affidavit of Publication

No. of Pages: 1 Date of Doc. 4/13/2010

Elsie A. Maruyama 4/13/2010
Notary Signature Date

ELSIE A. MARUYAMA NOTARY 88-127 PUBLIC STATE OF HAWAII

804453

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
Public Notice

STATE OF HAWAII } SS.
City and County of Honolulu

Doc. Date: JUL 26 2011 **# Pages:** 1

Notary Name: Patricia K. Reese First Judicial **Circuit**

Doc. Description: Affidavit of Publication

Patricia K. Reese JUL 26 2011

Notary Signature Date

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

Rose Rosales being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser and MidWeek, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser 3 times on:

07/24, 07/25, 07/26/2011

Midweek Wed. 0 times on:

______ times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Rose Rosales

Subscribed to and sworn before me this 26th day

of July A.D. 2011

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii

My commission expires: Oct 07 2014

Ad # 0000329656

LN: ________

PUBLIC NOTICE

USAG-HI Solicits Interest in Establishing Restoration Advisory Boards for Schofield Barracks, Kunia Field Station, Tripler Army Medical Center, and Fort Shafter

The U.S. Army Garrison, Hawaii (USAG-HI) is soliciting the public for interest in establishing a Restoration Advisory Board (RAB) for Schofield Barracks, Kunia Field Station, Tripler Army Medical Center, and Fort Shafter, Oahu, Hawaii. The Army is required to solicit the public every two years for interest in establishing a RAB at these installations for environmental cleanup under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The purpose of a RAB is to promote community involvement by giving the public the opportunity to regularly review progress and participate in dialogue with decision makers on USAG-HI's CERLA process.

If you are interested in participating in a RAB for Schofield Barracks, Kunia Field Station, Tripler Army Medical Center, and/or Fort Shafter, please contact the USAG-HI Restoration Program Manager (at 808-656-3092, carrie.nelson@us.army.mil) by September 1, 2011.
(SA329656 7/24, 7/25, 7/26/11)

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 86-467 STATE OF HAWAII

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

IMPC-HAW-ZA

07 SEP 2011

MEMORANDUM FOR RECORD

SUBJECT: Community Interest Documentation for FY11 Restoration Advisory Board (RAB) for Schofield Barracks, Island of Oahu, Hawaii

1. Community interest was solicited to develop a RAB for active Installation Restoration Program (IRP) and Military Munitions Response Program (MMRP) sites at Schofield Barracks, according to the Comprehensive Environmental Response, Compensation and Liability Act. Solicitation for interest in establishing a RAB for IRP and MMRP sites was published in Honolulu Star-Advertiser on July 24, 25, and 26, 2011. Affidavits of publication and the public notices are attached in Enclosure 1.

2. The solicitations collectively yielded less than five public response of interest.

3. As a result, the Garrison Commander determined that the public interest was not sufficient to warrant the establishment of a RAB for Schofield Barracks. Future solicitation to monitor community interest in establishing a RAB for Schofield Barracks will occur every two years. The next solicitation will occur in fiscal year 2013.

Encl

DOUGLAS S. MULBURY
COL, IN
Commanding

Appendix K

ASSESSMENT OF VAPOR INTRUSION EXPOSURE PATHWAY

Tier 1 Environmental Action Levels Surfer

Hawai'i Department of Health
(updated Fall 2011; rev Jan 2012)

Instructions For Use of EALs and EAL Surfer
(Refer also to Volume 1, Section 2 of EHE document)

Check with overseeing agency to ensure that you have the most up-to-date version of the EAL Surfer available and that the screening levels can be applied to your site (see Volume 1, Section 1.5).
Individual Surfer worksheets write-protected (password "EAL").

Steps 1 through 3 refer to the EAL - Site Input Worksheet ("EAL Surfer - Tier 1 EALs")

STEP 1. Input site Land Use, Depth of Impacted Soil and Groundwater Utility. Check with overseeing agency to ensure that proper categories are selected. "Unrestricted Land Use" category recommended for initial use at all sites to determine if future land use restrictions are needed. (Refer to Volume 1, Section

STEP 2. Select chemical of potential concern.

Surfer generates summary and detailed EALs for selected site scenario and chemical of concern.

STEP 3 (optional): Input representative site chemical concentration in soil, groundwater and/or soil gas. Surfer identifies if EALs exceeded. Refer to Detailed EAL worksheet tab to tentatively identified environmental hazards.

STEP 4: Laboratory method reporting limit takes precedence if greater than the EAL (assuming standard MRL for a commercial laboratory). Natural background concentration of metals takes precedence if greater than the EAL. (Refer to Volume 1, Section 2.9).

STEP 5: Determine vertical and lateral extent of soil and/or groundwater impacted above action levels to extent feasible. EALs may also be used as a guide for re-use of excavated soil.

STEP 6: Prepare *Environmental Hazard Evaluation* (EHE) with recommendations for additional actions (see Chapter 3). Identify potential environmental hazards. Evaluate need for corrective actions (e.g., cleanup to Tier 1 EALs, advanced evaluation of tentatively identified hazards, development of alternative cleanup levels, long-term management of contamination, need for land use restrictions and other institutional and engineering controls, closure with no further action, etc.). Refer to Chapters 4 and 5 in Volume 1of EHE guidance document and teh HEER office Technical Guidance Manual (HDOH 2009).

References:

HDOH, 2009, Technical Guidance Manual (2009 and updates): Hawai‘i Department of Health, Office of Hazard Evaluation and Emergency Response, http://www.hawaiidoh.org/

HDOH 2011a, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2011): Hawai'i Department of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

Tier 1 Environmental Action Levels Surfer

Worksheet is write protected. Disable protection under "Tools" if you have have trouble selecting options (password = EAL).

Hawai'i DOH
(Fall 2011; rev Jan 2012)

Steps 1 and 2:
Click in cell and use pull-down boxes to make selection.

STEP 1: Select [1]Site Scenario:

[2]Land Use:	Unrestricted
[3]Groundwater Utility:	Drinking Water Resource
[4]Distance To Nearest Surface Water Body:	>150m

STEP 2: [5]Select Contaminant

TRICHLOROETHYLENE

STEP 3 (optional): Enter site data.
(Potential environmental hazards highlighted in Red on Detailed EAL worksheet.)

Soil (mg/kg):	
Groundwater (ug/L):	70
Soil Gas (ug/m^3):	

Final Tier 1 EALs

Soil (mg/kg): 2.6E-01

Groundwater (ug/L): 5.0E+00 x

Soil Gas (ug/m^3): 1.2E+03

EALs exceeded. Refer to Detailed EALs (next tab) to identify specific environmental hazards that may be posed by contamination.

Notes

Volatile chemical. Collect soil gas data for site-specific evaluation of vapor intrusion hazards if Tier 1 action levels for this hazard exceeded (see Advanced EHE Options tab of Surfer).

Reference:

HDOH, 2010, Update to Soil Action Levels for TEQ Dioxins and Recommended Soil Management Practices (June 2010): Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, http://www.hawaiidoh.org/

HDOH 2011a, *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater* (Fall 2011): Hawai'i Department of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

HDOH, 2011b, Update to Soil Action Levels for Inorganic Arsenic and Recommended Soil Management Practices *(November 2011)* : Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response, http://www.hawaiidoh.org/

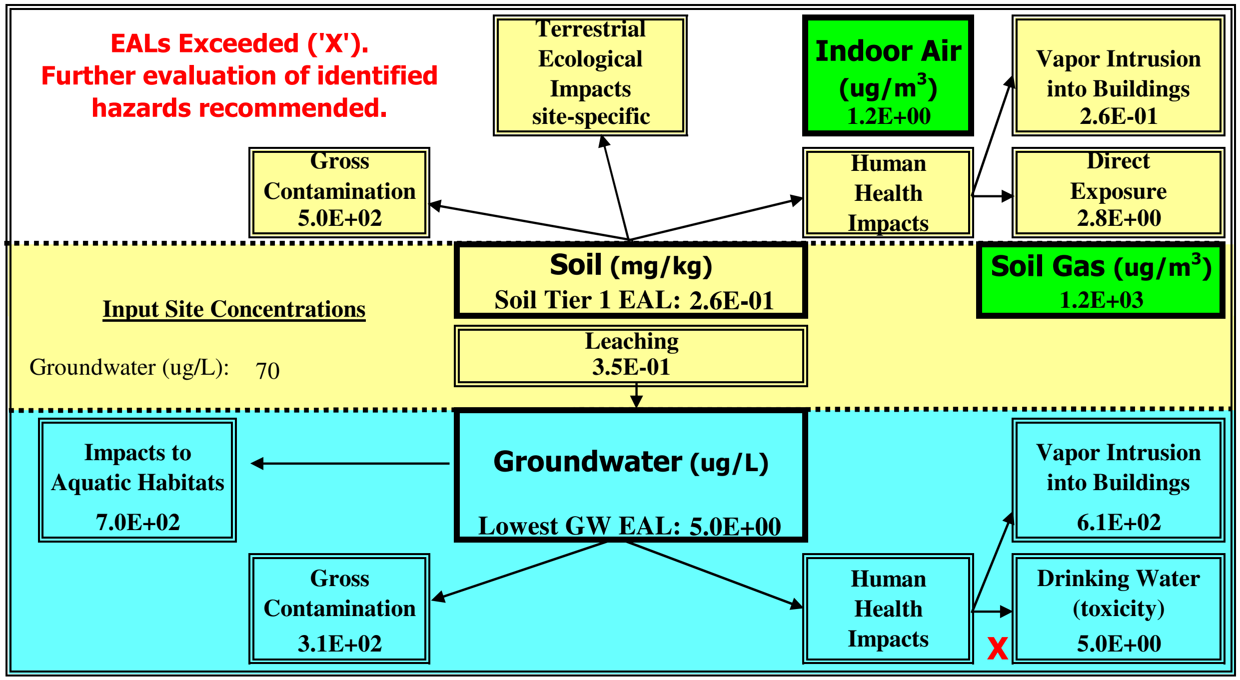
Notes:

1. Site scenario options based on scenarios used to develop EAL lookup tables (HDOH 2011a).
2. "Unrestricted" land use category suitable for residential housing, schools, day care, medical facilities, parks and similar sensitive uses. Use to evaluate the need for future land use restrictions.
3. See Section 2.4 of Volume 1 for determination of groundwater utility.

Tier 1 Environmental Action Levels Surfer
(Screening Levels For Specific Environmental Hazards)

Hawai'i DOH (Fall 2011; rev Jan 2012)

TRICHLOROETHYLENE



Selected Site Scenario	
Land Use:	Unrestricted
Groundwater Utility:	Drinking Water Resource
Distance to Surface Water:	>150m

Reference: HDOH 2011, *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater* (Fall 2011 and updates): Hawai'i Department of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

Site Scenarios: Site scenario options based on scenarios used to develop EAL lookup tables.

Soil Eco-Risk: Site specific, ecological risk assessment recommended at sites where anthropogenic contamination identified and sensitive, terrestrial ecological habitats could be threatened (see Volume 1 Section 4.2).

See also attached Tier 1 EAL Summary Report, Chemical Summary, Glossary and Advanced EHE Overview.

[1]Tier 1 EAL SURFER SUMMARY REPORT
Hawai'i DOH (Fall 2011; rev Jan 2012)

Site Name:	
Site Address:	
Site ID Number:	
Date of EAL Search:	

Selected Site Scenario	
Land Use:	Unrestricted
Groundwater Utility:	Drinking Water Resource
Distance To Nearest Surface Water Body:	>150m

Selected Chemical of Concern:	**TRICHLOROETHYLENE**

Input Site Concentrations	
Soil (mg/kg):	-
Groundwater (ug/L):	70
Soil Gas (ug/m^3):	-

Soil Environmental Hazards	Units	Tier 1 Action Level	[2]Potential Hazard?	[3]Referenced Table
Direct Exposure:	mg/kg	2.8E+00	-	Table I-1
Vapor Emissions To Indoor Air:	mg/kg	2.6E-01	-	Table C-1b
Terrestrial Ecotoxicity:	mg/kg	site-specific	-	Table L
Gross Contamination:	mg/kg	5.0E+02	-	Table F-2
Leaching (threat to groundwater):	mg/kg	3.5E-01	-	Table E-1
Background:	mg/kg	-		
Final Soil Tier 1 EAL:	**mg/kg**	**2.6E-01**		
	Basis:	**Vapor Intrusion**		

Groundwater Environmental Hazards	Units	Tier 1 Action Level	[2]Potential Hazard?	[3]Referenced Table
Drinking Water (Toxicity):	ug/L	5.0E+00	Yes	Table D-1b
Vapor Emissions To Indoor Air:	ug/L	6.1E+02	No	Table C-1a
Aquatic Ecotoxicity:	ug/L	7.0E+02	No	Table D-4a
Gross Contamination:	ug/L	3.1E+02	No	Table G-1
Final Groundwater Tier 1 EAL:	**ug/L**	**5.0E+00**		
	Basis:	**Drinking Water Toxicity**		

Other Tier 1 EALs:	Units	EAL	[2]Potential Hazard?	[3]Referenced Table
Shallow Soil Gas:	ug/m^3	1.2E+03	-	Table C-2
Indoor Air:	ug/m^3	1.2E+00	-	Table C-3

Notes:

1. Include Surfer Summary Report in appendices of *Environmental Hazard Evaluation* (EHE) for contaminants that exceed Tier 1 EALs (refer to Chapter 3 of main text).
2. Environmental hazard could exist of concentration of contaminant exceeds action level.
3. Referenced tables presented in Appendix 1 of EHE guidance document (HDOH 2011).

Reference: HDOH 2011, *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater* (Fall 2011): Hawai'i Department of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

Tier 1 Environmental Action Levels Surfer
Hawai'i DOH (Fall 2011; rev Jan 2012)
Summary of Toxicity and Fate & Transport Information
TRICHLOROETHYLENE

Human Toxicity Factors	Value	Units	Appendix 1 Reference Table
Cancer Slope Factor - oral	5.9E-03	$(mg/kg\text{-}day)^{-1}$	Table H
Cancer Inhalation Unit Risk Factor	2.0E-06	$(ug/m^3)^{-1}$	Table H
Reference Dose - oral	5.0E-04	mg/kg-day	Table H
Reference Dose - inhalation	1.0E-02	(mg/m^3)	Table H
Gastro-Intestinal Absorption Factor	1	unitless	Table H
Skin Absorption Factor	-	unitless	Table H
Target Excess Cancer Risk Used:	1.E-06	unitless	Table I-1
Target Hazard Quotient Used:	0.2	unitless	Table I-1

Aquatic Habitat Protection Goals	Value	Units	Appendix 1 Reference Table
Freshwater Chronic Goal	360	ug/L	Table D-4a
Marine Chronic Goal	360	ug/L	Table D-4a
Estuary Chronic Goal	360	ug/L	Table D-4a
Freshwater Acute Goal	15000	ug/L	Table D-4a
Marine Acute Goal	700	ug/L	Table D-4a
Estuary Acute Goal	700	ug/L	Table D-4a
*Bioaccumulation Goal	26	ug/L	Table D-4f

*Bioaccumulation goals used to screen surface water only (refer to Volume 1, Chapter 2 of EAL text).

Fate & Transport Information	Value	Units	Appendix 1 Reference Table
Molecular Weight	131		Table H
Physical State	volatile liquid		Table H
Organic Carbon Partition Coeff. (koc)	6.1E+01	cm^3/g	Table H
Diffusivity in air	6.9E-02	cm^2/s	Table H
Diffusivity in water	1.0E-05	cm^2/s	Table H
Solubility (water)	1.3E+03	mg/L	Table H
Henry's Law Constant	9.8E-03	$atm\text{-}m^3/mol$	Table H
Henry's Law Constant	4.0E-01	unitless	Table H

*Potential Health Effects	Target Organs & Health Effect
Carcinogen	X
Mutagen	
Alimentary Tract	X
Cardiovascular	
Developmental	X
Endocrine	
Eye	X
Hematologic	X
Immune	X
Kidney	X
Nervous	X
Reproductive	
Respiratory	
Skin	
Other	

*Not intended to serve as a comprehensive source of toxicological information. Ultimate potential health effects dependent on exposure dose, duration of exposure and numerous other factors. Refer to Appendix 1, Table J for specific references.

Reference: HDOH 2011a, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2011): Hawai'i Department of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

Example advanced Environmental Hazard Evaluation options when Tier 1 EALs exceeded and cleanup to EALs is not feasible (see also Chapter 4 of EHE Guidance)

Hawai'i DOH (Fall 2011)

SOIL

Direct Exposure:	Use Tier 2, Direct Exposure Spreadsheet to calculate more site-specific action levels. Refer to Tier 2 action levels for arsenic, dioxin and technical chlordane (see Chapter 4 of EHE guidance, HDOH 2008)
Vapor Emissions To Indoor Air:	Proceed directly to site-specific vapor intrusion evaluation (e.g., collection of soil gas data an comparison to screening levels). Input site-specific data into Tier 1 soil vapor intrusion models (not generally recommended).
Terrestrial Ecotoxicity:	No further action required if site lacks sigificant terrestrial eco habitats or threatened/endangered species. Proceed to site-specific assessment if significant habitats or threatened/endangered species are present.
Gross Contamination:	Inspect site (or boring cuttings) for potential gross contamination concerns. Include future management of grossly contaminated soil in an Environmental Hazard Management Plan if identified and left in place at the site.
Leaching:	Use laboratory batch test to evaluate contaminant mobility and potential groundwater impacts (see Chapter 4 of EHE guidance, HDOH 2008).

GROUNDWATER

Drinking Water (Toxicity):	No Tier 2 option for adustment of promulgated Maximum Contaminant Levels (MCLs). Refer to USEPA Tapwater Screening Levels (USEPA 2008). Review updated toxicity data used in model to develop risk-based action level for drinking water concerns in cases where a promulgated MCL was not available.
Vapor Emissions To Indoor Air:	Proceed directly to site-specific vapor intrusion evaluation (e.g., collection of soil gas data an comparison to screening levels). Input site-specific data into Tier 1 soil vapor intrusion models (not generally recommended).
Aquatic Ecotoxicity:	No Tier 2 option for adustment of promulgated Surface Water Standards (refer to Table F-4d). Review aquatic ecotoxicity data used to develop chronic or acute action levels in cases where a promulgated standard is not available.
Gross Contamination:	Inspect site (or boring cuttings) for potential gross contamination concerns. Include future management of grossly contaminated soil in an Environmental Hazard Management Plan if identified and left in place at the site.

SOIL GAS (Vapor Intrusion)	Input site-specific building design and ventilation data into Tier 1 soil gas vapor intrusion models. Evalaute need to proceed to indoor air study.

Soil and Groundwater Background	Review published or site-specific data to evaluate natural background concentrations of metals in soil or groundwater if Tier 1 EAL exceeded and no known potential source of a release.

Reference: HDOH 2011, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater (Fall 2011): Hawai'i Department of Health, Hazard Evaluation and Emergency Response, http://hawaii.gov/health/environmental/hazard/index.html

Tier 1 Environmental Action Levels Surfer
Hawai'i DOH (Fall 2011)

GLOSSARY

Site Scenarios

Land Use: Unrestricted land use includes single-family homes and high-density housing areas. Also appropriate for other sensitive property uses, including schools, day care centers, medical facilities, etc.

Groundwater Utility: Groundwater categorized as drinking water or nondrinking water resource. See Section 2.4 of Volume 1 for determination of groundwater utility at a specific site.

habitats. Chronic aquatic toxicity goals used to screen groundwater situated ≤150m from an aquatic habitat. Acute aquatic toxicity goals used to screen groundwater situated >150m from an aquatic habitat. Potential for groundwater contaminated above chronic goals to migrate into the 150m buffer zone must also be evaluated.

Soil EALS:

Direct Exposure: Address direct exposure and toxicity to humans. Includes incidental ingestion, dermal contact and inhalation of vapors or dust particles in outdoor air.

Vapor Emissions To Indoor Air: Address potential impacts to indoor air due to the intrusion of vapors from underlying, contaminated soil.

Terrestrial Ecological Impacts: Address potential toxicity to terrestrial flora and fauna. Site specific, ecological risk assessment recommended at sites where anthropogenic contamination identified and sensitive, terrestrial ecological habitats could be threatened.

Gross Contamination: Address odor, nuisance, generation of explosive vapors and other, non-risk related hazards posed by heavily contaminated soil.

Leaching: Address potential leaching of chemicals from soil and subsequent impact on first-encountered groundwater. Action levels for metals not included (must be evaluated on a site-by-site basis).

Groundwater EALs:

Drinking Water (Toxicity): Address potential toxicity to humans using the water as a drinking water resource. Based on promulgated Primary Maximum Contaminant Levels (Primary MCLs) or equivalent.

Vapor Emissions To Indoor Air: Address potential impacts to indoor air due to the intrusion of vapors from underlying, contaminated groundwater.

Discharges to Surface Water: Address potential chronic impacts to aquatic organisms. Promulgated chronic surface water standard or equivalent.

Gross Contamination: Address odor, nuisance, generation of explosive vapors and other, non-risk related hazards posed by heavily contamniated groundwater. For drinking water resources, Secondary Maximum Contaminant Level (Secondary MCL) or equivalent for taste and odor concerns also considered.

Indoor Air and Soil Gas EALs:

Indoor Air: Address direct exposure to volatile chemicals via inhalation.
Soil Gas: Address intrusion of subsurface vapors into a building and subsequent impacts to indoor air.

Appendix L

RESPONSES TO COMMENTS

Reviewer:	1. Steven P. Mow 2. Harry Ball
Affiliation:	1. HDOH HEER Office 2. USEPA Region IX
Date:	1. June 19, 2012 2. June 14, 2012

Comment type:	**Where to comment:**	**Where to submit:**
• *Substantive* - S (comments on significant and substantial issues) • *Editorial* - *E* (grammatical, etc.) • *General – G* (comment, question)	Enter comments in the following table. Be sure to reference the section/page/paragraph numbers, and the suggested editorial or substantive change.	(Please send comments to: Carrie Nelson carrie.nelson.civ@mail.mil

Com-ment No.	Comment type (S/E/G)	Section No.	Comment	Response
1 DOH	S	3.3	p.3-2, Section 3.3 History of Contamination – More information should be provided regarding what conditions were achieved that allowed for its removal in 2000.	Text will be added to the end of Section 3.5, explaining that the CERCLA process had been completed for 4 OUs, and that remedies were in place for OUs 2 and 4, thus leading to removal of Schofield Barracks from the NPL.
2 DOH	S	3.3	p. 3-3, Section 3.3 History of Contamination – As live munitions were reported and encountered in the landfill, shouldn't this site be included as a munitions response site?	This project is conducted under the Army Installation Restoration Program (IRP), and followed the CERCLA process. While some live munitions were documented at the site (common in many military landfills), MEC and MC were not considered the primary risk drivers. Furthermore, all sites under USAG-HI were evaluated under the 2002 Final CTT Inventory Report for possible inclusion into the MMRP program. OU-4 was not identified as a possible munitions response site. The current remedy is protective of human health and the environment since the surface has been cleared and capped and any potential MEC or MC has been isolated and contained along with other landfill constituents.
3	S	6.4	P 6-19, Section 6.4 Community Relations for Operable Unit2	This section will be revised to add 1) the 5-year review

Com-ment No.	Comment type (S/E/G)	Section No.	Comment	Response
DOH			and Operable Unit 4 – Appendix J mentions only the public notices that were put in the newspaper. Were any other efforts made (neighborhood board meetings, other RAB meetings held by the other services, direct contact with State and City for that region) to solicit participation? Please inform the HDOH when the next round of solicitation in FY13 occurs so that we may engage the public regarding their participation.	public notice that was published on May 13-15 2012; 2) that letters went out to the established list of stakeholders, 3) that interviews were conducted with stakeholders currently operating ASTS', and 4) that copies of the Draft 5YR document were placed in the Mililani and Wahiawa libraries. HDOH will be informed when the next round of solicitations in FY13 occur, and of any upcoming community relations events.
4 EPA	S	6.1.2.1	Section 6.1.2.1 discusses in rather general terms the results of a trend analysis of groundwater data that is also presented in Tables 4.3, 6.2, and 9.2. The criteria _for determining whether concentration data shows an "increasing" trend is not presented. The descriptive language varies between the tables and there is inconsistent information presented for TCE in several wells [3-2803-07 (Del Monte #4); 3-2901-02 (Supply Well 1); and 3-2901-04 (Supply Well 3)]. At a minimum, the trend evaluation for the wells should be consistent. The authors may want to consolidate the tabulated trend interpretations to Table 6.2 which includes "Trend Evaluation" in the table title. More importantly, the location of the GW plumes is not plotted. In addition, while the following statement is presented in the 5YR Protectiveness Statement - "Results from the monitoring well network show that the plume is not migrating downgradient" - this statement is not supported in the document by plume capture or other analysis. It would be preferable to have a simple contouring program on all the data and a few plume maps over time prepared with a discussion that supports the conclusion that the plume is not migrating.	The results of the groundwater trend analysis will be clarified in Tables 4.3, 6.2, and 9.2. Specifically the variations will be described in quantitative terms to avoid confusion, and the qualitative statements like "increasing" or "slightly increased" will be eliminated. Generally, the plume has been characterized by minor fluctuations, but has remained largely stable over the years. Given the selected remedy of wellhead treatment documented in the ROD for OU2 and the stability over the years, the value of a more detailed contaminant trend analysis within the plume, and defining the precise boundaries of the plume are not as important as they might be for in situ remedies and/or monitored natural attenuation. While groundwater isoconcentration contours are normally shown on figures in similar sites, they are not used here since the Army will provide wellhead treatment for any wells that the COCs exceed the criteria established in the ROD independent of specific trends or plume boundaries. Mark's Note: While I agree that the exact plume boundary is not important for the sake of the remedy, I do think that showing the plume contour is still necessary for the Five Year Review. Provide a figure showing the lateral extent of the 5 ppb isocontour(s) for TCE. It looks to me like the location of this line hasn't changed over time. If so, state that in the narrative. This isocontour will be very helpful in looking at the new wells that have been installed. It looks like Well #3-2801-03 is the only well that is inside the plume boundary. You can provide some description in the protectiveness and ICs discussion that while several new wells new are outside the boundary of the plume only one well has been placed inside the plume.

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				Describe that the well is for irrigation only.
5 EPA	S	4.1.1	TI Waiver The site TI waiver is discussed very briefly in Section 4.1.1 as follows: "A technical impracticability (TI) waiver was prepared (EPA, 1996), which supports the point-of-use treatment. Because of the TI waiver, the cleanup goals apply only at the wellhead and not throughout the aquifer." The document should present the major provisions of the TI waiver including the definition and location of the TI zone and any monitoring or treatment requirements.	The major provisions of the TI waiver will be added to the text.
6 EPA	S	6.1.2.3	ICs - OU2 The document does not support the position that there is adequate institutional infrastructure either required through institutional controls or otherwise to prevent inadvertent exposure to site contaminants through the drinking water pathway. The 5YR [Section 6.1.2.3] identifies a number of "new wells" found in the monitoring network area. Table 6.4 indicates that 4 of the wells are used for agricultural irrigation and 3 of the wells are used for domestic supply. The document does not confirm whether these wells were sampled prior to use to confirm that there is no route of exposure to site related groundwater contamination. In Section 4.1.2 the document merely states that "During five-year reviews, DLNR will be contacted to see if permits for any new wells have been issued since the previous five-year review. . Although owners of private wells are not required to test the water from their wells, private well owners are warned by the commission that water from their wells should not be considered safe to drink unless it is tested first." This does not describe an adequate control mechanism to ensure protectiveness. Confirmation must be presented that these wells are not contaminated and that there are adequate controls in place to prevent inadvertent exposure to site contamination going forward.	The Army agrees that additional measures or ICs are needed to confirm new wells are not contaminated, and that there are adequate controls in place to prevent inadvertent exposure going forward. While reviewing all new well applications and pumping permits is part of the 5-YR Review process, the Army realizes that this review should happen on a more frequent basis, possibly once a year as part of the Annual Report for OU-2 & OU-4. Although the Hawaii Safe Drinking Water Act does require sampling for TCE and CCl for all new drinking water wells, it will be proposed that the owners of the identified new wells be contacted and briefed, and the wells be sampled for COCs as necessary. Additionally, further coordination between HDOH, DLNR and USAG-HI DPW Environmental, needs to be established when a new well application is received within a specified geographic area where groundwater impacts exist, so those applicants can be notified, and their wells sampled as necessary. This approach has already been outlined to HDOH and details are being formalized.
7	S	4.2.2	ICs - OU4	The adopted ICs for OU4 will be aligned with the ICs

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EPA			The document indicates [Section 4.2.2] that the remedy includes a component to "Implement institutional controls (landfill gas and groundwater monitoring, five-year site review, land-use restrictions, and site security)." The document [Section 7.2.1] does indicate that "Any new wells installed in the vicinity of the landfill would also require permits, and because of the institutional controls in the base environmental records, a request for the use of groundwater for water supply would not be approved without provisions for water treatment." Nonetheless, it is unclear what ICs were adopted and their effectiveness as implemented. ~~[Mark: The document [Section 7.2.1] goes on to say "At the time DoD property is transferred from federal ownership, DoD or the transferee will execute a restrictive covenant regarding land use controls then in effect for environmental restoration sites in a form acceptable to DOH and consistent with DoD policy." However, it is not clear whether this is a requirement. We need ORC to weigh in on these IC issues.]~~	referenced in Section 7.2.1., and the effectiveness of the IC will be evaluated in Section 7.2.1.
8 EPA	S	7.1.2	ARAR Analysis In Section 7.1.2, the document says that there have been "No changes to the exposure assumptions, toxicity data. The document should be revised to acknowledge the results of the recent update of TCE toxicity in IRIS. We have developed standard language to be included in 5YRs to discuss this issue as follows: Groundwater results are compared to U.S. EPA Regional Screening Levels (RSLs) as a first step in determining whether response actions may be needed to address potential human health exposures. The RSLs are chemical-specific concentrations that correspond to an excess cancer risk level of 1x10-6 (or a Hazard Quotient (HQ) of 1 for noncarcinogens) developed for standard exposure scenarios (e.g., residential and commercial/industrial). RSLs are not de facto cleanup standards for a Superfund site, but they do provide a good indication of whether actions may be needed. In September 2011, EPA completed a review of the TCE toxicity literature and posted on IRIS both cancer and non-cancer toxicity values	A reference to the updated toxicity data for TCE will be added to the text as follows: "*It should be noted that U.S. EPA has recently updated TCE Toxicity in IRIS, but still considers the TCE MCL of 5 µg/L protective for both cancer and non-cancer effects. Groundwater results are compared to U.S. EPA Regional Screening Levels (RSLs) as a first step in determining whether response actions may be needed to address potential human health exposures. The RSLs are chemical-specific concentrations that correspond to an excess cancer risk level of 1x10-6 (or a Hazard Quotient (HQ) of 1 for noncarcinogens) developed for standard exposure scenarios (e.g., residential and commercial/industrial). RSLs are not de facto cleanup standards for a Superfund site, but they do provide a good indication of whether actions may be needed. In September 2011, EPA completed a review of the TCE toxicity literature and posted on IRIS both cancer and non-cancer toxicity values which resulted in lower RSLs for TCE. The screening level for chronic exposure for cancer*

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			which resulted in lower RSLs for TCE. The screening level for chronic exposure for cancer excess risk level of 1x10-6 is 0.44 µg/L. EPA uses an excess cancer risk range between 10-4 and 10-6 for assessing potential exposures, which means a TCE concentration between 0.44 and 44 µg/L. The current Maximum Contaminant Level (MCL) for TCE of 5 µg/L which is within the revised protective carcinogenic risk range. EPA's 2011 Toxicological Review for TCE also developed safe levels that include at least a 10 fold margin of safety for health effects other than cancer. Any concentration below the non-cancer RSL indicates that no adverse health effect from exposure is expected. Concentrations significantly above the RSL may indicate an increased potential of non-cancer effects. The non-cancer screening level for TCE is 2.6 µg/L. EPA considers the TCE MCL of 5 µg/L protective for both cancer and non-cancer effects. In addition, the document [Section 6.1.1.1] refers to "EPA, Office of Water, Drinking Water Standards and Health Advisories, EPA 822-B-00-001, Summer 2000." This document has been updated as follows: 2012 Edition of the Drinking Water Standards and Health Advisories, EPA 822-S-12-001, April 2012. The ARAR analysis in Appendix C should refer to and be compared against this version of the DWSHA.	*excess risk level of 1x10-6 is 0.44 µg/L. EPA uses an excess cancer risk range between 10-4 and 10-6 for assessing potential exposures, which means a TCE concentration between 0.44 and 44 µg/L. The current Maximum Contaminant Level (MCL) for TCE of 5 µg/L which is within the revised protective carcinogenic risk range. EPA's 2011 Toxicological Review for TCE also developed safe levels that include at least a 10 fold margin of safety for health effects other than cancer. Any concentration below the non-cancer RSL indicates that no adverse health effect from exposure is expected. Concentrations significantly above the RSL may indicate an increased potential of non-cancer effects. The non-cancer screening level for TCE is 2.6 µg/L. EPA considers the TCE MCL of 5 µg/L protective for both cancer and non-cancer effects.*" The document referred to in Section 6.1.1.1, "EPA, Office of Water, Drinking Water Standards and Health Advisories, EPA 822-B-00-001, Summer 2000." will be updated and replaced with "*2012 Edition of the Drinking Water Standards and Health Advisories, EPA 822-S-12-001, April 2012*". The ARAR analysis in Appendix C will be amended to refer to and be compared against this version of the DWSHA.
9 EPA	S	6.4	Community Outreach Community Relations for Operable Unit 2 and Operable Unit 4 is discussed in Section 6.4. The 5YR should include in the Appendix a copy of the public notice to document this effort. Documentation of where and when the notice was published and or mailed out should be provided.~~ [Mark: EPA HQ has taken the position that a public notice must be published in the local paper in order to meet public notification requirements. Is there a good reason why that was not done here? Or should we ask for publication of the notice in the paper?]~~	An affidavit of public notice published will be added to the Community Relations Appendix J.

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10 EPA	S	6.2	OU 2 Site Inspections The inspection identified [Section 6.2] a number of issues [lack of access to certain wells; broken latches on well head covers; substantial corrosion on the bottom brackets on the air stripping towers]. The maintenance of GW air stripper units [Schofield Barracks WTP - Rusting of stripping tower brackets. (App I, Photo 8 and Photo 9)] appears especially problematic. ~~[Mark: This is certainly a deficiency. The question is whether it should be considered a protectiveness issue for the purposes of the 5YR and tracked or a maintenance issue that will be addressed separately. Let's discuss.]~~	The Army considers both the monitoring well condition issues, and the corrosion on the bottom brackets on the air stripping towers as operation and maintenance (O&M) issues. Protectiveness of the wellhead treatment remedy has not been compromised. The following test has been added to the end of Section 6.2.1: "*It should be noted that routine operation and maintenance (O&M) issues such as those documented above are consistently addressed under an O&M plan as they arise, and there are always a number of these issues in larger monitoring network like the one for OU2. AMEC has confirmed that there are procedures in place under the O&M plan. Consequently, they are not considered to compromise the either the current or future protectiveness of the remedy*."
11 EPA	S	6.2.1, 6.2.4 6.3.3	Site Inspection Photos The photo label references in Section 6.2.1 thru 6.2.4 and 6.3.3 need to be updated to that actual photo numbers in Appendix I.	The photo label references in Section 6.2.1 thru 6.2.4 and 6.3.3 crossed referenced with the actual photo numbers in Appendix I, and corrected as necessary.

Reviewer:	Monica L. McEaddy, Environmental Engineer, Federal Facilities Restoration and Reuse Office, 5106P, United States Environmental Protection Agency (U.S. EPA)
Affiliation:	U.S. EPA
Date:	6/21/2012

Comment type:	**Where to comment:**	**Where to submit:**
• *Substantive* - S (comments on significant and substantial issues) • *Editorial* - E (grammatical, etc.) • *General* – G (comment, question)	Enter comments in the following table. Be sure to reference the section/page/paragraph numbers, and the suggested editorial or substantive change.	(Please send comments to: Carrie Nelson carrie.nelson.civ@mail.mil

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1	S	ES	On page ES-1, the Executive Summary, the purpose of the five-year review is not to address the three questions below. The purpose of the five-year review is to determine if the remedy remains protective of human health and the environment and whether the remedy is performing as designed.	The 2nd Paragraph text in the ES will be revised as follows: "The purpose of the five-year review is to determine if the remedy remains protective of human health and the environment and whether the remedy is performing as designed. U. S. EPA guidance proposes three key questions to be addressed in the five-year review to achieve this purpose. They are as follows: • Question A: Is the remedy functioning as intended by the decision documents? • Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAO's used at the time of the selection still valid? • Question C: Has any other information come to light that could call into question the protectiveness of the remedy?"
2	E	ES	On page ES-1, the last bullet, "to allow the Army to procure funds" seems to not be an appropriate statement.	The text "to allow the Army to procure funds" will be replaced with "to allow the Army plan and allocate

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				resources".
3	E	ES	On page ES-3, last paragraph, it should state that the next review is September 30, 2017.	Text in the last sentence now states "The next five-year site review is schedule to begin by March 2017, and be completed and approved by 24 September 2017." The 5YR-Review date for this site is September 24 not September 30.
4	S	Summary Form	On the five-year review summary form, name of person signing should be the federal person. Also, the review period is start and end date of the review. The type of review is statutory.	The review period will be changed to "March 1, 2012 to September 24, 2012". The type of review will be changed to "Statutory". We acknowledge the federal authority signs the five year review; however, there is no area for identification of the signing authority on the five year review summary form.
5	S		I question the protectiveness statement for OU-4. Since there are erosion and cracking issues of the landfill, I do not agree that the remedy is protective in the future. I would suggest short-term protectiveness and that in order for the remedy to be protective in the long term, follow up actions should be taken such as a maintenance plan for the landfill.	A maintenance plan does exist for the landfill and ~~T~~the U.S. Army believes that routine operation and maintenance (O&M) issues like cracking and erosion control are consistently addressed under the O&M plan as they arise.~~,~~ ~~and~~ The 5-Yr Review Inspection & Evaluation has confirmed that these are procedures in place under the O&M plan and are followed. Consequently, they are not considered to compromise either the current or future protectiveness of the remedy.
6	E	5.0	On page 5-1, the second sentence in first paragraph should begin with "this".	The second sentence refers to the second five-year review. "This" will be added to the beginning of the third~~second~~ sentence.
7	S	9.3	On Table 9.3, the answers to questions of whether the issue affects current and future protectiveness are incorrect. In each example, the answer is NO except the future protectiveness of OU-4. Also, the due date for the milestone should not be ongoing. There needs to be a specific date.	After evaluation, only one protectiveness issue for OU-2 remains. Since there is little value in having a table with one line item, Table 9.3 will be removed from the document. The OU-2 protectiveness issue will be addressed in the current Section 9.1 narrative. Please leave Table 9.3 in the document. The Recommendations table is a key component of a Five Year Review and we like to see it as a stand-alone feature, even if it only has one entry. I would change the issue to focus on the plume area. State that one new irrigation well has been placed inside the plume boundary and three wells

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				have been placed outside the plume boundary but within the extended monitoring well boundary. The recommendation is to evaluate the wells for inclusion in the monitoring well network and to improve the implementation of the ICs with better coordination with the State of Hawaii water well permitting program. The "Affects Protectiveness" is then "No" because there are no impacted drinking water wells.